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The Bancroft Memorial Lecture.[1]

THE CHANGING POINT OF VIEW.

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INTRODUCTION: JOSEPH BANCROFT.

THERE are few more impressive facts in biological science than the circumstances that attend the rise and fall of animal types. Type after type has been begot, has had its little day in which it strutted across the stage of life and then passed away for ever.

It is not given to us, with our short span of life, to witness these things, save when the final act is played and we realize that some beautiful and harmless form of life has ceased to be. Nevertheless, though it may not be given to us to see the rise, the heyday and the decline of distinctive animal types, probably we have all—and with many regrets—witnessed the whole drama enacted by some type of humanity. There is no need to go back to the now extinct types of Hogarth or Rowlandson or even Cruickshank. These things are nearer to hand.

The red-faced genial busman, the busman of Charles Keane and even of Phil May; the hansom cabby, flash of dress and quick of repartee; we have seen both of them pass—and surely with regrets. The comparatively inarticulate, sallow-faced young motorman—an impersonal being—has replaced the far more human and intimate personalities of the old horse-drawn days.

And I fancy it is not only in these utilitarian affairs, where the machine is working its will, that these things are seen. I believe that in science we are witnessing a very sad passing of a type; indeed, alas, we have probably already witnessed it.

In popular estimate, as it is manifested in fiction and the films, the present-day scientist is a clean-

[1] Delivered at Brisbane, June 5, 1931.

shaven, hard-faced, somewhat inhuman person, who, cloistered in a laboratory, holds a test tube to the light and sees in it Nature's profoundest secrets. And there is much truth in the popular estimate. The ideal modern scientist is somewhat akin to the pale and impersonal motor man. His genial, robust and human prototype—the doctor-naturalist—has passed with the bus driver. Many will admit a full-blooded affection for the bus driver with all his broad human associations; and it is to be hoped that there are still some left who deplore the passing of that fine type, the medical man, who was, in every sense of the terms, a liberally educated, deeply learned, yet generalized naturalist.

Of such stock were the many fine surgeon-naturalists of the older scientific exploring expeditions. Such were the great traveller naturalists, and such were those many big-hearted, human, country practitioners who have been naturalists in the best sense of the word. Jenner might be ranked among them, Erasmus Darwin would certainly occupy a high place, and Joseph Bancroft, whose memory we are met to honour, is assuredly of their company.

Now, in dealing with such big hearted characters, all of whom have unfortunately passed away, it may be permissible to claim some latitude, such as was claimed by Stevenson, in picturing those that we have learned to love from no more than their works and some fragmentary histories. Given this freedom of treatment, I think it is justifiable to picture something very like an apostolic succession of spirit in the persons of Erasmus Darwin and Joseph Bancroft. And here we have rather more than mere friendly imagining for our guide, for of the one there are Miss Seward's "Memoirs" and of the other Dr. Sandford Jackson's personal reminiscences.

From these two sources we may be permitted to draw some sort of parallel between the lives and ways of these two very human doctor-naturalist philosophers. Both were very human; both, as I imagine them, very lovable despite, as one might say, their "little ways." Both full of human faults, of human kindness; and all tinctured with a wide and real knowledge of Nature and a great human sympathy. Both were medical men, both botanists, a combination that has so often produced the very best type of naturalist—produced it so often that it would be redundant to quite instances from the long line stretching from Marcello Malpighi to Sir David Prain. Both had certain weaknesses in their commerce with their fellows. Of Erasmus Darwin it is recorded "he became early in life sore upon opposition, whether of argument or conduct, and always resented it by sarcasm of a very keen edge." Of Joseph Bancroft it is said "he was constantly at loggerheads with various people, as the minutes of committee in the years 1868 to 1870 reveal." And to neither man let us ascribe these things as failings.

Both had their botanical loves. Those of Erasmus Darwin we know from his poems. Of Bancroft's from his rather more practical breeding of rust-resisting wheats, hybrid grapes, and "a particularly good strawberry"—and Erasmus Darwin himself had great liking for sweet fruits.

Both, among minor similarities, had a queer aptitude for terse and rather unexpected forms of repartee. When Erasmus Darwin advised the fat woman with the meek little husband to witness the "bull-running at Tutbury," he is well matched by Bancroft in his answer, "Eat them," to the questioner who sought advice on methods of eradicating flying foxes from his orchard. Darwin's dictum on "the plant Kalima" is bettered by Bancroft's monosyllabic "Duelling."

And again both had a sort of genius for inventing rather unpractical gadgets. Bancroft invented an inhaler for chloroform "that appeared to contravene every rule in the giving of anæsthesia." Erasmus Darwin invented a wonderful carriage that contravened every rule applicable to horse-drawn vehicles. But Bancroft had the greater success in this. Of Erasmus Darwin it is recorded that "from this whimsical carriage, however, the doctor was several times thrown" and in the end got a fractured patella that gave him a permanent limp. Of Bancroft's whimsical inhaler, however, Dr. Jackson has said that "so far as I know no fatalities occurred with the instrument in his hands." It may be that the parallel could be drawn far closer: it may be that even so much as has been drawn is purely of imagination. It matters not on which side the error may lie. The single fact remains that in Bancroft there was one of those human types the passing of which we can only deplore. He was one of a race of doctor-naturalists that has done such yeoman service in science: a race that is possibly dead—killed, like the bus driver, by a newer age of mechanism and specialization.

Meanwhile it may be well to inquire how, in the changing modes of human thought, these big, human men (name them as genius or ordinary human men as you will) have served their turn.

The Changing Point of View.

It is not to be denied that the first thirty years of the twentieth century have witnessed a most remarkable alteration in the outlook of those who are the leaders in certain spheres of scientific inquiry. This change is all the more remarkable since it has its origin in an altogether unexpected quarter. For centuries the physicist has, with a lofty superiority begot of the exactness of his science, frowned upon the little efforts of the biologist in his more spiritual flights towards mysticism or idealism. There was no place for mysticism in a science that measured and weighed and tested everything from atoms to stars. A foot rule, a balance, a crucible and a retort; these things left no place for uncertain ideals, for guess-work or for the hope that anything save measurable and ponderable matter, obedient to fixed and familiar laws, could properly be entertained in the scientist's conception of the universe around him.

Now the biologist has this to his credit, or discredit, that he has ever been ready to accept the dictates of the physicist. Indeed, he has always stood in a good deal of awe of the man who could back his assertions by a convincing appeal to the foot rule. It was of no avail to resort to mysticism or idealism in the face of the pronouncements of an older science that could produce mathematical formulæ as evidence of the correctness of its findings.

Throughout the history of science the biologist has taken his cue from the physicist and has at times attempted to adopt his methods. Even he has learned somewhat to despise his own science and to deplore the fact that it cannot claim to be exact, since there is so much of it that cannot be weighed or measured or summed up in a mathematical formula.

Certainly if the biologist leaned towards any ancient hankering after mysticism or vitalism or idealism; if he fancied that human knowledge were always liable to some element of inexactness, and that all things could not be expressed in metrical fashion or by mathematical formulæ, he kept these things to himself in the presence of the physicist. Moreover, if his mind leaned naturally towards a teleological explanation of certain of the phenomena of life with which he was acquainted, he was careful, were he minded to take rank in the world of orthodox science, to conceal the fact.

And now there has come about a strange thing. Just what this strange happening consists in may be appreciated in the recital of a, possibly apocryphal, story. It is said that when a distinguished man of science was informed that the work of one of our most eminent modern physicists had been recognized by the bestowal of a knighthood, he remarked that a bishopric would have been a far more appropriate honour. And in truth any biologist who reads the writings of those who are eminent in modern physical science must needs rub his eyes and wonder if all this is real or only a dream. For it seems likely that the biologist is a Rip Van Winkle, awakened after a century of sleep. When he read of "the Great Architect of the Universe" (as we do in the works of Sir James Jeans[1]), or when we come across "Creator" and "God" written with capital letters and invoked as causal factors in the universe (as we do in the writings of Sir Arthur Eddington[2]), there must come a doubt if the century that intervenes between the "Bridgewater Treatises" and today is not itself to be explained away by some application of the principle of relativity.

The biologist must needs stand agape, bewildered by it all. He gave up his mysticism; he gave up a Great Architect of the Universe, out of pure deference to the more exact findings of the physicist. The biologist schooled himself, and maybe much against his own inclination, to spell no words with capital letters save perhaps Mechanism, Variation and Natural Selection. And now the physicist has deserted him, and is moreover doing those very things he taught him to despise. In truth the biologist is very like the little boy who, taught by a slightly older brother to despise girls, subsequently catches him making ardent but immature love to the girl who lives next door.

When physical science produced a Copernicus (1473-1543), biological science countered with the begetting of a Vesalius (1514-1564). Newton (1642-1726), as a representative of physical science, found his biological counterpart in Harvey (1578-1657). But when Einstein, and a host of others, gave rebirth to physical science, the challenge was unaccepted and it has been rightly said of biology that "its Einstein is still unborn and everybody feels the need of his coming."[3]

As we review the situation today, biological science may be said to be, intellectually, in a state of suspense. Its old leaders have failed it, and by a rapid transition of thought, cast it back a century in its philosophy. How will its reconstruction be effected? How will it, thrust back, as it must be, on a period despised by the prevailing school of biological thought, readjust itself to the newer outlook of its ancient mentor, the physical sciences? Will it too (to employ a crudity) make love to the girl who lives next door? To this question there is at present no answer, and none will be forthcoming until the Einstein of biology is matured in the womb of time.

One thing is certain and this is the fact that if biological science is to have rebirth and to fall into step with physical science, there must needs be a reconsideration of its most cherished dogmas. That one should assert that an intellectual return to the period of the "Bridgewater Treatises," tempered by a just appreciation of the aims of John Hunter, might be the main factor in the renaissance of biology, would, probably even in 1931, be to court the disapproval of orthodox biological science. But I believe that such a risk is worth running and that such a prophecy is even now showing signs of fulfilment.

The Historical Study of a Triviality.

Meanwhile, in the absence of an Einstein of biology, it may be profitable to examine the stages that have already been passed through in the long story of man's outlook upon life. It is only by obtaining some sort of historical perspective, and by seeking the origin of our present beliefs, that we may be assured of a safe foundation for any conclusions we may come to concerning the future. It is to be doubted if biological science has ever been sufficiently historically minded to guarantee the proper assessment of its most cherished dogmas. It is probably for this reason that certain amateurs, such as Samuel Butler, with a far wider outlook than the average biologist, but with no professional knowledge of the subject, have been able to make such brilliantly successful raids upon the strongholds of biological orthodoxy.

But there is every sign that today biology is beginning to realize that it has a past as well as a

future, and that only by an appreciation of the past can it have assurance of the soundness of its beliefs, and so sort out what is ephemeral, and due to the fashion of the time, from that which is true and permanent. Since E. S. Russell published his noteworthy studies[4] there have been many works issued that deal exhaustively with the historical aspect of biological trends of thought. In all these books the treatment is scholarly and the aim is to present the evolution of human thought concerning the more majestic manifestations of life. The subject has indeed been treated so adequately in recent years, that no warrant could be found for dealing with it within the necessarily limited compass of a lecture. Here, then, no scholarly presentation is attempted, and far from considering the more sublime aspects of the phenomena of life, selection is made of a subject bordering upon the ridiculous.

It is not so much the number and the range of ascertained facts available to the scientific man as the general outlook upon nature prevailing at the time, that mark off essential periods in the history of science. And often enough the general outlook upon nature is best appreciated by the current views upon subjects that can only be ranked among the trivialities of learning. Straws show the way the wind blows, and in like fashion hairs may help us to follow the trends of thought that have characterized some very definite periods in the phases of man's changing attitude towards nature. It might seem a stupid thing that we should attempt to determine a man's outlook upon nature by noting his opinions concerning the distribution of human hair: but the business is not without promise.

Man is a comparatively naked animal when he is regarded as a mammal; but even his nakedness is not uniform, for there is a very definite arrangement of the hair upon his body, whereby, though for the most part his skin has some hairy covering, certain regions are truly hairless. That some parts of a man's skin are hairless and others hairy cannot be said to be one of the grandest manifestations of Nature's handiwork. Nevertheless, the fact has place among those *curiosa* of human external anatomy that, throughout the ages, have arrested the attention of a certain type of philosopher and tempted him to the propounding of an explanation. It is in the various explanations that have been provided by philosophers that we may find some landmarks in the progress of the ever-changing outlook of man upon nature.

The Galenical Outlook.

For Galen (A.D. 131-201) and for that pre-Vesalian rut of schoolmen who followed him no discussion of the growth and disposition of hair could be undertaken without appeal to the theories of the temperaments and elements. Consideration must be made to the nature of the part in relation to heat and dryness, heat and moisture, cold and moisture and cold and dryness; and only by knowing this nature could the distribution of hair be understood.

> There is also required a convenient place, as a foundation wherein the roots of the hairs may be established, and that is the skin, which of all other parts is fittest for their breeding, saith Galen in the first chapter of the second Book de Tempremente, because it is neither too dry nor too moist; for as neither in ground where water always standeth, nor in ground that is over dry and worn out of heat can anything be brought forth; so on an over-moist or over-dry skin no hair can grow.[5]

The general theory was a satisfying one and it held, moreover, an easily implied analogy with the growing of wheat or vines. Nor, perhaps can we wholly reject the theory, even today, when we have regard to the distribution of hair tracts upon skin surfaces normally kept somewhat moist by secretions. But if we concede so much to Galenical teaching, this is not to go all the way with those many who retain a lingering tradition of the likeness of the growth of hair to that of vegetation and who picture the effects of cutting the hair as being similar to those achieved by mowing the lawn. Nor must we overlook the fact that, though Galen attached much weight to the temperaments, he was ever ready to ascribe the ordering of the hair, as the ordering of all things, to the planning of an all-wise Creator.

The "Natural" Viewpoint.

But there is little need to discuss the Galenical outlook upon this matter: the drawn-thread work of theory in which the schoolmen delighted was destined to pass with the advent of those great, simple, ordinary men who, in succession from Andreas Vesalius (1514-1564) to John Hunter (1728-1793) at least saw life steadily even if it were not given them to see it whole.

Even those who remained with one foot in the sea of Galenical tradition, but with the other planted firmly on the shore of Vesalian anatomy, were ready to take the plain view of the great, ordinary men in most matters that involved no more than simple observation. Helkiah Crooke (1576-1635) wrote obscurely and with one eye on traditional teaching when he described the general hairy covering of the human body; he refused to come altogether ashore until he dealt with that ancient problem involved in the hairless palms and soles. From the general hairiness of the body, says he, "we must except the skin of the palms and soles of the hands and feet, because" (according to Galen) "in them there is a large tendon immediately under the skin, which being exceeding thick and dry, makes it uncapable of hairs; but I cannot admit of that reason, seeing a Hare hath also that broad tendon, and yet hath not these parts void of hair. Therefore we say that Nature hath made these parts hairless both for use that they might be more sensible, as also for motion."[6]

Here is the simplicity of the plain man's view emerging from the complexity of the schoolman's day dreams. Here is that steadiness of vision of the Hunterian School, seeing everywhere in nature the adaptation of structure to function. The functions that the sole of the foot and the palm of the hand were called upon to discharge demanded that

these parts be devoid of hair, though otherwhere the man might be an Esau for hairiness. And in all ways the thing was natural, or ordained by Nature.

Though most would think to honour John Hunter by naming him a genius, it is possible we might pay him, and those others of his kind, higher tribute when we rank them as great, ordinary, simple-minded men. For more than two centuries their point of view prevailed. The simple thesis that structure was determined by, and adapted to, function satisfied these men: and the initiation and regulation of this very natural process they were prepared to ascribe to Nature.

The "Bridgewater Treatise" Period.

John Hunter was dead in 1793. The new century saw at its birth a change that, maybe, lay not so much in the manner of outlook as in the manner of its expression. We have arrived at the period of the Reverend William Paley, sometime Archdeacon of Carlisle—the period of "Natural Theology" and the "Bridgewater Treatises."

During those two centuries that lay between the heyday of Vesalius and the glory of John Hunter, there were many who held views that were hardly to be ranked as those of the great ordinary men. There were many who realized, just as they did, the very natural contrivance of structure to function, but who were not prepared to relegate the ordering of this adaptation to such an impersonal influence as that termed Nature by the ordinary men. As an instance of the expression of this point of view during the eighteenth century we may take a little work entitled "An Essay Concerning the Infinite Wisdom of God Manifested in the Contrivance and Structure of the Skin of Human Bodies" (1724). In this work the author, "a lover of Physick and Surgery," tells us that "Finally, that the serviceableness and beauty of the hair might be defective in nothing, it has a comely situation given to it all over the body . . . where hair might be troublesome or indecent, we find none, as on the fingers' ends, or palm of the hand." Nevertheless the general expression of the articulate students of living things was that of a simple or natural belief in the harmonizing of structure and function by natural agencies, or, if the agency needed a name, Nature. They did not postulate the presence of an infinitely wise God in the background.

The opening years of the nineteenth century saw a change in that for Nature it substituted "designing Creator" and in the place of the demands of Nature saw the purpose of a divinely originated plan. Moreover, unlike the impersonal administration of the something termed Nature, the interventions of the Creator were imminent, personal and commonly aimed especially toward the direct benefit of civilized and Christian white men as apart from the rest of creation. Naturally, the point of view was no new one, but it came to its best expression during those years that passed between the death of John Hunter and the advent of Charles Darwin.

When Paley discussed hair, it was always with one end in view. It was his purpose to point out the suitability of the contrivance and the obvious truth that this suitability furnished evidence of the direct and beneficent forethought of the Creator. With a large disregard for the porpoise and the animals after his kind, Paley asserts that "the human animal is the only one that is naked" and then points out that "had he been born with a fleece upon his back" he would have suffered oppression in passing towards the Equator.[7] Of this, as of every other instance of adaptation to which he directs attention, he maintains that the obvious and only explanation "is to refer it to a designing Creator." Paley's "Natural Theology," despite the opinions of the later years of the nineteenth century, must ever rank as a great work; and if we translate "designing Creator" as "Nature" there is not much between the views of John Hunter and those of the Archdeacon of Carlisle.

Moreover the Archdeacon, with all his anthropomorphic theology, might claim, by virtue of his saying that "the man who is not sometimes a fool is always a fool," to be an ordinary common sense person, or alternatively, a genius.

The Darwinian Revolution.

But the nineteenth century was destined to be no more than middle aged before there came a revolution of thought; and this revolution was not one of mere expression, it was a fundamental alteration of outlook upon Nature and upon life. It was that great, yet unnecessary, upset of the ordinary man's ideas involved in the indiscriminating acceptance of the principles of Darwinian evolution. Without attempting to define this rather stupid upheaval of thought, we can again take hair as our Plimsoll-mark of current opinion. Charles Darwin reflected upon the matter of the distribution of hair upon the human body and worded his conclusions in this fashion: "The whole surface" (of the body of the human fœtus) "including even the forehead and the ears, is thus thickly clothed; but it is a significant fact that the palms of the hands and the soles of the feet are quite naked, like the inferior surfaces of all four extremities of most of the lower animals. As this can hardly be an accidental coincidence, we must consider the woolly covering of the fœtus to be the rudimental representation of the first permanent coat of hair in those mammals which are born hairy."[8]

It is possible to ponder for long over this apparently profound statement without being able to appreciate any significant meaning to be attached to it. Is it the fact that the human fœtus has a covering of lanugo, or the fact that no hair grows on the palms of its hands or the soles of its feet, that leads to the necessary conclusion that the woolly covering of the human fœtus is a rudimentary representative of the first permanent coat of the hairy mammals?

These statements have been accepted as scientific profundity for so long and have been passed as

genuine currency in every form of quotation and restatement that their discussion today is hardly worth the while. Save that we are intended to be impressed with the fact that man's hairy covering is an inheritance from "hairy mammals," and that somehow his naked palms and soles attest to the truth of this, it is difficult to assign any very logical meaning to the whole statement; nor at this time is it profitable to seek for it. Nevertheless, it is instructive to see how Darwin's assertion struck a thinker of the older school. Commenting on this passage, Dr. Bree wrote:

> But Mr. Darwin forgets that hairs upon a man's hand or the sole of his foot would be an unnecessary incumbrance, and opposed to the beautiful design by which his structure is adapted to the purposes of his existence.[9]

Here is the old guard speaking; but speaking with the voice of the Vesalians and Hunterians passed through the mouthpiece of Paley.

It is also instructive in this connexion to follow the trend of thought expressed in Darwin's involved passage, as it is elaborated by his followers. As Haeckel expressed it:

> In the human embryo, the embryonic woolly hair usually covers the entire body, with the exception of the palms of the hands and the soles of the feet. These parts remain bare, just as in all apes and most other animals. This remarkable woolly covering can only be explained as an inheritance from our primordial long-haired ancestors, the apes.[10]

There is a very striking similarity between the statements of Darwin and Haeckel, and again that stupid point concerning the nakedness of palms and soles does duty for argument. The logic of the statements may still remain outside the question: it is enough for us to note that now it is not Nature, nor a designing Creator, nor even an ordinary hairy mammal to whom we are indebted for these things. The ape has come nearer. Our hairless palms and soles are due to the ape; and now the whole thing is settled, for if ever there was certainty expressed in biological science and finality in its dicta, it is in the work of Ernest Haeckel that they should be found.

As the nineteenth century closes, we cease to be concerned in the beauty of those contrivances that had so much impressed the more simple men of a previous generation. To admire the perfection of an adaptation is to be suspect of a belief in teleology and at the end of the nineteenth century it were better that a man should believe in a geocentric universe or in a flat earth than that he should be branded a teleologist. There is now no more of the discussion of adaptation of structure to the demands of function. Structure is the only thing that matters; function is of no concern to the zoologist; beauty of adaptation probably does not exist save in human imagining. Structure were best studied upon dead things, pickled and dried and stored in museums. How an animal fitted that peculiar niche of the environment in which it found itself, might constitute an amusing and harmless study for the village naturalist, but it was no fitting subject for the professed zoologist. Would a zoologist make study of frogs he must take as his guide the great work that deals thus with the wonders of colour adaptation in these creatures: "The colouration is described from spirit-specimens, even should the life colouration be known":[11] and it was in this way that Australia's greenest frog became known as *Hyla caerulia*. It is well that all men did not accept the warning, that it were better to have no curiosity concerning the colour of live frogs, else Lister's great work might have remained undone and the world been the poorer. Looking backwards, it is easy to detect, in the extraordinary wealth of zoological discovery that marks this period, a series of rather barren victories; and this despite the fact that, in the minds of many, this was the golden age of zoology. New knowledge was being added to the already overburdened human heritage of facts: but the knowledge concerned the structure of the dead rather than the meaning of life. Animals possessed a definite structure, not because Nature had adapted them to their mode of living, nor because they had been designed to fit that state of life into which they were called, but because they could not help it, since they were structural complexes, and often structural misfits, by reason of their ancestry.

Nature had now no capital N and Creator was not even written in any style, but a capital A was assigned unreservedly to the Ape.

The Pessimistic Outlook.

All those who hold true scientific knowledge to be of more value than vague imaginings or traditional beliefs, must rightly acclaim the advent of Darwinian evolution as ushering in the dawn of the brightest day in the life of zoological science. But somehow, with all the brilliance of the dawn there was lacking that joyous outlook upon life that should rightly accompany so glorious a daybreak.

To the many there came a realization of the overwhelming truth of Blanco White's unique sonnet and a longing for the return of darkness, since this sudden flood of light were like to render men blind to "such countless orbs."

In truth the light of Darwinian evolution very fully revealed the "fly and leaf and insect"; but of its message it could hardly be said that "Lo! creation widened in man's view."

In all this there is maybe no fault in the teaching: the defect may lie in those to whom the teaching came at second hand. And that is possibly true, but it is not to be denied that for most men the last half of the nineteenth century was productive of a rather gloomy outlook upon life; and this despite much material prosperity and the knowledge that science was ever achieving new conquests. Nor can it be claimed that such an outlook was unwarranted either for the ordinary man or for the scientist, if by chance either of them had an eye upon anything less immediate than the structural details of a long-dead specimen in a museum. For the teaching of Darwinian evolution had far-reaching implications. Surely if we were just bundles of

accumulated structures, inherited from a varied set of ancestors, it might by chance happen that the whole of our heritage would not be entirely suitable to our present needs. We should expect to find misfits and disharmonies displayed, as it might be with a pauper who inherited a dress suit, or a coral-islander who was bequeathed an ice pick by his uncle.

And so it happened that intelligent men busied themselves in searching among the complexities of structure to discover the unfitting and obsolete parts. The great minds of zoological science sought for crude disharmonies as others before them had sought for beautiful harmonies; and they discovered them as freely.

Hair again may help in the understanding of the new outlook. "This covering," wrote Metchnikoff, "is known as lanugo, and consists of strands of hair, disposed very regularly all over the body, save on the hands and feet. There is no doubt but that this is functionless, and is no more than an inheritance from the old ape-like condition. Later on it falls out and is replaced by the ordinary downy covering of the body. In adult life and particularly in old age, the hairs of the second coat tend to grow very long and so to form a covering that is neither beautiful nor in the least degree useful. We may take this as a first example of a disharmonious condition in the human body. Hairs, incapable of protecting the body from cold, survive merely as an ancestral relic and may become even harmful."[12] There is a familiar note running all through this passage. The naked palms and soles, the lanugo, the ape ancestor—all is there: but there is added the depressing thought that, far from evincing harmonious adaptation or design, the affair is all hopelessly wrong and disordered. For Metchnikoff, and those who followed him, all nature was an ironic jumble of misfits: a world of creatures predestined to failure by reason of their inherited disharmonies: a cruel, unpurposeful struggle against fate in the form of useless and harmful relics accumulated from our ancestry. A very complete revolt was made from the "Natural Theology" of the Reverend William Paley, but one not unprofitable to the surgeon, since he alone seemed capable of shaping our ends and relieving us of our dangerous heirlooms. And so we end a short review of the unfolding of man's outlook upon hairs and, indirectly, upon life and the nature of living things, on a note of pessimism.

Readaptations.

Having unwound a small part of the scroll of history on which is written the changing outlook of man upon Nature, and having suffered some depression of spirit in the process, it is best to attempt to wind it up again and see if, in all its stages, the train of thought revealed was necessarily a logical or a just one. First, then, for the period of pessimism and the disharmonies that made so dismal a theme for Metchnikoff and his followers. To point out the fallacies underlying many of Metchnikoff's imagined disharmonies is a simple matter, as simple as is the process of unmasking some of the alleged beautiful harmonies dwelt on by the natural theologists: but all the misfits cannot be disposed of in this way. Misfits and disharmonies there certainly are, and when the business of retaining or multiplying misfits goes far enough, the animal is eliminated.

But the fact that the school of the pessimists failed to take into account, was the astonishing way in which Nature (and here we have rolled back the scroll another stage) has been at work setting to rights the disharmonies as they, by changing circumstances, have arisen. The natural theologists sang the praises of the perfection of adaptations; but, alas, the beauty of readaptations has never had its chronicler. Yet it is an inexhaustible theme, for the greatest wonders of all living responses to the ever-varying demands of changing functions are to be seen in readaptations.

The male sex cell is the spermatazoon, the female cell the ovum. For the male cell there is a simple functional rôle. Its one clear mission is to pass from the body of the male and to come into contact with the female cell, to the end that fertilization may be secured. For simple motile cells to leave the body of the male, the simplest and oldest ducts in the world will suffice and those ancient channels that drain the perigonidial cavity or cœlom become the sperm ducts of the whole animal world. Nothing more is needed, unless by reason of circumstances it is necessary for the male cell to reach the female cell whilst this is still retained within the body of the female. Such circumstances have arisen over and over again in complete independence, and every time the emergency has arisen, an intromittent organ has been devised. How many times this need has been felt and satisfied, every time independently of all previous experience, it is almost impossible to guess. How many times Nature has effected this readjustment and invented and reinvented intromittent organs, in the whole range of animals from amœba to man, is beyond computation. Every time the need has arisen, from any cause whatsoever, the appropriate organ has been produced; appropriate in that its adaptation has of necessity to be in perfect harmony with the channel by which the ovum is to be reached.

But compared with the story of the passage of the female cell, that of the passage of the male cell is a simple, uneventful narrative. The female cell must carry the potentialities of independent life of the new individual and this, in itself, necessitates an increase in bulk. It may be far too large to make exit by the old cœlom ducts and the whole story of its passage is one of perpetual makeshifts. Time and again the whole process of reproduction seems about to be faced with disaster: but every time some readjustment is made, some new device resorted to, and all is well. New ducts must be made for the passage of the large ova and, even among the vertebrates, that which we term the oviduct in the fish is not made in the same way, nor from the same

materials, as that which we term the oviduct in the mammals. Intromittent organs have been invented over and over again as the need for them has arisen; and it would seem that even the "Müllerian" duct has been invented at least twice in the vertebrates.

Ova may be shed as simple unfertilized cells or they may be shed as less simple fertilized cell masses or, by chance of circumstance, they may be retained for long within the body of the female and be extruded as anything from an embryo just starting its development to a fantastically adult guinea-pig.

The production of living, and more or less mature, young has been achieved by different forms of life in complete independence and many times. Hardly any group of living things has failed to make the experiment—often at great risk; and the devices that have been resorted to to secure its safety are without number.

First, there is need for the furnishing of some place in which the developing young may be securely retained within the body of the female—and nature has invented many "uteri."

Next, there must be some mechanism to effect the nourishment of the young whilst retained in the body of the female, and probably few would now deny that by "placenta" we mean a functional adaptation to this end, rather than a structural entity that was invented once and for all time.

And, in the end, there must be a way for the developed young to leave the maternal nidus, and the intromittent canal may answer this purpose or, by chance, it may not. And here, if anywhere, is material for a study in makeshifts, readjustments and dodges resorted to by Nature in the face of emergencies. I doubt if there be a much grander manifestation of the powers of readaptation than that seen among the marsupials. The intromittent organ of the male has been developed; the intromittent canals of the female are perfected; internal fertilization is secured. The embryos begin their development, a makeshift "uterus" is formed for their accommodation, and a "placenta" is devised for the nourishment of the developing young. But the intromittent canals will not suffice for their exit. Here is a real dilemma—a real disharmony; and Nature is at the cross roads. The young bandicoots that have been nurtured in the "uterus" and nourished by their "placentæ" have no passage by which their birth into the world can be effected. Heroic measures are resorted to. Nature solves the problem by making a new passage on the emergency, as a rupture of tissues, and the young escape. And in the end, in the phylum of the marsupials, so satisfactory is this new birth passage that it becomes permanent and so developed before its need arises. Here is a dilemma solved by a readjustment. Certainly a disharmony in reproduction arises in the marsupials: yet the wonder is not in the disharmony, but in its extraordinary solution. Nor must we overlook the strange happening whereby that which seems to have been in the beginning the meeting of an emergency, and which is repeated in the emergency of every subsequent pregnancy, becomes at last an established thing that is inherited and the making of which antedates its need. The median vagina of the bandicoot seems to have been "acquired" in the crisis of marsupial birth. As such it was transmitted and its advent effected ever earlier; so that the more primitive bandicoot matron must needs repeat the process every time she is parturient; but the more specialized virgin kangaroo is born possessed of this curiously acquired passage. To affirm our belief in such an interpretation might need a generous dispensation from the orthodox of modern biological science, nevertheless the whole thing would have appeared very natural to Lamarck, to Erasmus Darwin and even to Roux: and it is impossible to withhold credence even if this involves a risk of being considered unorthodox, and we must further remember that when all this business of making a new birth passage is done with there is yet a pouch to be made for the accommodation of the immature young.

Surely this half-told story of some of the readaptations that have been brought about in the functional history of reproduction, gives a picture of the plasticity and the adaptability of Nature very different from the gloomy canvas as painted by Metchnikoff and his school. The wonder is not that disharmonies have arisen. When we have a true realization of the frequency with which change of function has been effected, the wonder is that disharmony is not universal. The marvel lies in the wonderful way in which change of function has been met by the most singular makeshifts in the way of structure. Further than this, a consideration of the host of such readaptations as are apparent everywhere in Nature, must of necessity involve the implication that, although it has become habitual to define organs as structural conceptions, there can be no definition of an organ that is not made solely in terms of function. Here the scroll is wound back another stage, for it was for the demonstration of this truth that John Hunter did his life work and formed his great museum. Intromittent organs, uteri, vaginæ, oviducts, placentæ—all have been made over and over again and the only common bond between them all is the function they discharge.

There is, maybe, no need to carry the matter further and in truth the whole body could be ransacked and every portion of it would teach the same lesson: but the thing has been so little appreciated that some note may be made of the story of the eye. It is said that Stumius declared that "the examination of the eye was a cure for atheism"; and Paley wrote many of his finest passages upon the beauty of adaptation or design as seen in the structure of the eye. The impossibility of the development of an eye by Darwin's theory was a stumbling block to many, even in the days of the first acclaim of Darwinism. But Nature has shown a fine disregard for theories in the matter of the eye. It may be impossible to conceive the development of an eye by the process of chance structural

variations and natural selection, and for my part I certainly hold that it is so. But in this event what is to be said when we realize that eyes have been developed over and over again in complete independence? Probably we would not be going too far if we claimed that half a dozen times has the demand for eyes arisen in entirely different animal stocks and that eyes have been forthcoming with total disregard to what has gone before or what is to come after in the way of producing eyes. When an eye has been completed with all its complicated parts there is still need for a mechanism to adjust its focus, and this business of focusing has been effected in at least half a dozen entirely different ways. Even an eye cannot properly be defined in terms of structure: it can only be expressed in its function of being a light-receptive organ and as such it has been made over and over again.

Nor can we leave the study of the eye without noting that extraordinary dilemma by which the vertebrate eye became imprisoned within the cavity of the brain and seemed like to lose its function, in that it was cut off from the rays of light, the detection of which was its sole purpose. And then we must be astonished at the way in which the business was set to rights and the eye grew out again towards the light; but withal became turned inside out in the process. The vertebrate "inverted" eye is a makeshift eye that was overtaken with disharmony and was readapted and so serves its purpose, since it enables the astronomer to examine the distant nebulæ and the microscopist to become familiar with the structure of bacteria. And having noted all this, then look to the way in which Nature, having made eyes whenever they were needed, and having saved them when their development was hazardous, is prepared to let them go by default when their function ceases in animals whose lives are passed in darkness.

Finally, let us turn again to trivial things and see if hair, which provided the texts for so many philosophers, gives, in its more modern study, cause for belief in the beauty of readaptation. Danforth in the most recent monograph on the subject of hair tells us that "since morphologic structure is regulated by many factors, some of which may vary or be replaced by other factors, homology must in general be looked on as relative and not absolute."[13] For some it may be difficult to recognize these as being comfortable words and yet they tell, in better scientific form, the story attempted here.

So we may pass back over the period of the pessimists with the assurance that the beauty of readaptation is a thing far more evident in nature than is the blot of apparent disharmony. And in this assurance we must realize that the function or, if it is preferred, the purpose of life is the determinant of structure which in itself is no more than an expression of the purpose or function.

Adaptations.

Still turning the scroll backwards we come again to that remarkable upheaval of thought caused by the advent of Charles Darwin's thesis that evolution was brought about by the occurrence of chance structural variations acted upon by an agency termed natural selection. Fortunately, there is today no need to dwell in retrospect upon this phase of thought. The need is done away with now that it is permitted to a man (Dr. Sunda Lal Hora) to declare, in the *Transactions of the Royal Society*, that: "Structural modifications are produced through changes of function"; and to follow this up by saying: "One thing has become quite clear to me—that evolution is no more than the adaptation of organisms to environment."[14]

We may, by way of comment, note that the back-to-Hunter movement is complete and that here is the kind of evolution understood by many men before the advent of Darwinism. This very satisfactory state of affairs has been brought about by the fact that, with the dawning of the twentieth century, a change came over the methods employed by the best minds in biology. The structure of the dead ceased to be so attractive to the younger men, when knowledge of the living, which seemed to hold so much greater possibilities, was to be had. Nature study, that pastime to which even yet there is somewhat of a stigma attached as being the pursuit of a harmless village naturalist, has become the professional occupation of the trained biologist. It is because Dr. Hora has conducted his nature study in the peculiar environment of the torrential mountain streams of India that he has come to the conclusions that have been quoted.

We are, therefore, free, by virtue of the most recent dictates of professed biologists, to extend our claims for the function or purpose of living matter. We have already agreed that it is function or purpose that causes the development and determines the structure of organs and parts; and now we have warrant for claiming that it is function or purpose that shapes the whole animal; and that the adaptations and readaptations, resulting from this, constitute what is known as evolution.

It is possible that the future may hold it legitimate to inquire if, since organs can be defined only in terms of function, may not a like definition be extended to the animal itself, and so, in the determination of a species, function as well as structure need consideration? The day for asking such a question has not yet dawned and it were better not to anticipate it, since already the newer outlook upon life has made complication enough for the systematic zoologist.

The power of function or purpose to create structure has admittedly led to the repeated and entirely independent development of organs that (as an example) we class together as eyes. If such complex things as eyes can be produced over and over again by the demands of function or purpose, may not animals, equally similar in a totality of their structure, be produced more than once?

Now to this question, which sounds almost as absurd as the other, we know the answer; and, for my part, I see no more difficulty in believing that

an animal that we are all agreed to term a monkey has been produced twice, than in agreeing that eyes have been made maybe half a dozen times in independence.

"Convergence is the result of independent functional adaptation to similar ends" is the dictum of the zoologist who has, more than any other, compelled recognition of the phenomenon."[15] Similar functional ends, such as the requirements of internal fertilization, have arisen many times, and each time, in entire independence, intromittent organs have been produced: but so, too, there have arisen the requirements of living underground, of living on honey or ants, of climbing up trees or flying or (in Dr. Hora's instance) of existing in the peculiar environment of a mountain torrent. Probably "moles" have been made as often as eyes. It is function or purpose that has produced the mole type of animal, and the occasion for producing it has arisen many times and in many parts of the world. There is no need to recapitulate the teeming instances of the workings of convergent evolution. We may be content with the considered statement of the orthodox palæontologist that "fishes of the same general outward appearance and habit have originated repeatedly from progressively higher groups," and be permitted to wonder with him "whether animals of apparently the same family, genus or species may not originate more than once from separate sets of ancestors."[16]

Convergence has been described by one living anatomist as a "fashionable and seriously overworked doctrine."[17] Convergence may be more truly termed an omnipresent phenomenon of life than a doctrine; and the pity is that its appreciation is not more fashionable and that it is not permitted more scope in solving the complexities of the phylogenies of living things.

Ever since the narrowing influence of the mid-nineteenth century viewpoint was brought to bear upon men's minds, there has been a reluctance to accord whole-hearted recognition to the plasticity of nature. It is when we take another step that this influence is more clearly shown. It was a favourite theme with Samuel Butler that the organs and parts of a man's body and the tools by which he supplemented them had little real difference between them. Hands were tools that man had made attached to his body and forceps those that he had made in independence of his body. Now hands, if we limit the conception to grasping organs, have been made again and again: it would seem that there should be rather less difficulty in imagining that forceps might have been invented many times. But there is a school of anthropologists that argues thus:

> We know in the case of every modern invention that it was made in one definite place and became diffused over a wider and wider area until everyone in any part of the world who is making use of this particular invention is indebted directly to one man in one particular place who was originally responsible for initiating the process.[18]

And so, from such premises, it is argued that all man's inventions, all his beliefs and ceremonies, all his arts, all the components of civilization and civilization itself have originated once and once only and have spread by "diffusion" through time and space to all those centres where men have ever congregated. But this is probably the last outpost of that narrowed mode of thought that delighted in the archetype and, later, in a rigid uniserial monophyletic evolution. The future is for those who are prepared to admit that function or purpose has made stomachs repeatedly; has made moles many times and monkeys twice; and, in the same way, has called into being all that is good and evil in the complexities of advanced civilization at least as often as it has made monkeys. And now, though our steps have been retrograde, and though we have had least mental sympathy with the beliefs of the golden age of the late nineteenth century, we have come to a far more plastic, far more hopeful view of life. Even if in our return we have not lingered in the camps of the natural theologians and, with Paley, substituted Creator for Nature, we have certainly come nearer to translating function as purpose. Nor should we be out of harmony with modern biological thought if we included in the definition of life the clause that in all things it is essentially purposive.

Reciprocal Adaptation.

"Evolution is no more than the adaptation of organisms to environment." We may accept this statement as summing up our present day views as to evolution; and we have already agreed that it is function or purpose that leads to the development of adaptation in the organism. But the statement that evolution is no more than the adaptation of organisms to the environment tells only half the story of evolution, since it deals only with one aspect of a dual system. There is a heads to adaptation as well as a tails. The strange little crabs of the genus *Hapalocarcinus* are perfectly adapted to their environment within the colonies of corals of the genus *Pocillopora*. But in a reciprocal way, the growth of the coral that furnishes the environment is perfectly adapted to the crab that avails itself of the environment. As Karl Semper has noted, and as anyone who has made study of these things when living in pools upon a coral reef, can affirm, "the influence of the corals on the crabs is as direct and important as that of the crabs on the corals."[19] And this, of course, is only one instance from among those teeming examples that are met with wherever living things become intimately related. Indeed it is true to say that "a survey of the relations of animal species to one another shows above everything else that none of them is carrying on a solitary traffic with its lifeless surroundings."[20] Reciprocal adaptation is involved in all those strange animal associations embraced in parasitism, mutualism, commensalism, synœciosis and servitude. It has to be considered in all those complex mutual modifications that occur when insects are the fertilizing agents for plants, or where herbivorous creatures are adapted to, but at the same time cause adapta-

tions in the vegetation that constitutes their environment. We may focus our attention upon those adaptations that make the interior anatomy of the holothurian sea slugs suitable to their functional needs. But we must remember that, from the point of view of a fish (*Fierasfer*), a crab (*Pinnotheres*) and a mollusc (*Eulima*) that make their home inside them, the interior of the sea slug is nothing more than environment that has become adapted to their needs, as they have become adapted to the demands of their environment.

Now in these instances we see that the whole process is a reciprocal one; that there is an adaptation of environment as well as of organism. Possibly our appreciation of the mutual adaptation in these cases is due to the fact that here both organism and environment are alike living creatures. But it is surely only a step from considering the circumstances of a crab living in a gall reciprocally developed by a coral, or living within a bivalve mollusc, or in the interior of a sea slug, to considering a crab living in the crevices of inanimate rocks and in an environment of sea water with its dissolved salts and gases. What, then, of the inanimate physical and chemical environment; would it be absurd to look for evidence that it, too, had undergone adaptation or evolution?

Inorganic Evolution.

In proposing to inquire if evidence could be found for any reciprocal adaptation and evolution on the part of the inanimate environment, we are asking what, today, seems a foolish question. But there have been periods in man's changing outlook upon Nature during which the quest for this very evidence was a natural undertaking and one entered upon with much zeal. It was Paley who wrote: "But what shall we say to agreements which exist between things generated and things *not generated*?"[21]

One precursor, and probably an essential one, to any evolutionary theory was the conception of what Sir Thomas Browne, in 1635, termed "a stair, or manifest scale, of creatures, rising not disorderly, or in confusion, but with a comely method and proportion."[22] This is the germ of the idea that was so greatly elaborated by Charles Bonnet (1720-1793) and Jean Baptiste Rene Robinet (1735-1820) as a general conception of an *échelle des êtres*. The same theme was further pursued by Charles White, of Manchester (1735-1813), in his discussion of "regular gradations" in Nature:[23] and with Charles White we come within measurable distance of an academic concept of evolution. Now it must be remembered that the *échelle des êtres* was not merely an attempt at zoological or botanical classification. It was a definite conception that fitted all things, animate and inanimate, into one grand sliding scale of increasing complexity and perfection. The whole stairway, as it was pictured by various philosophers, naturally differed considerably in detail; but, roughly, we may say that all were agreed that the order passed in descending scale from animals to plants and so to things of doubtful nature but still having life, and onwards in descending order to lifeless solids, liquids and gases. For some, the gradations culminated in angels at the upper end, for others "fire and more subtile matter" terminated the scale below. The actual details matter but little; the great concept was that all natural objects, living and non-living, could be embraced in an ideal scale.

Now for that older school, that may be termed the School of Academic Evolutionists, evolution, if it were to be regarded as an actual living force, must be supposed to act upon the whole of the stairway of Nature. If, in addition to a scale of increasing perfection, there were actually a development of increasing perfection—if one step of the stairway could change into the step above it—then all things, from gas to man, must be included in the evolution. As the stairway was arranged, and with the knowledge available at the time, there was but little difference apparent between those things that showed life at its lowest ebb and those things which, though lifeless, manifested certain activities. Nor was the idea that the most lowly manifestation of life could take origin from the non-living one that was foreign to men's minds. The groundwork was laid for the erection of a very comprehensive academic scheme of evolution.

But soon there came a real theory of evolution and this concerned itself only with the upper, or living, portion of the stairway of Nature. With the advent of Darwinism any concern with the evolution of the non-living ceased as a philosophic employment; and what had been achieved by an older generation was soon forgotten. As a matter of fact, the achievement had been noteworthy, for the writers of certain of the "Bridgewater Treatises" had assembled a very striking array of facts bearing upon the evolution of the non-living, lower half of the stairway. This work had been accomplished, not so much with the object of demonstrating the development of the non-living into the living (for this would have been contrary to the tenets of the natural theologists), but rather with the purpose of showing the manner in which the non-living had been adapted in order to make life possible. It is the strength and also, maybe, the weakness of the curriculum laid down for the student of medicine that he is supposed to acquire some sort of smattering of physical and chemical science in addition to his biological training. Now I suppose no medical student was ever called upon to display his knowledge of the *échelle des êtres*: but if we take the case of a medical student serving his apprenticeship in the 'nineties of the last century, it is easy to define his mental horizon. The whole of his biological course was laid down upon the foundation built by Huxley and was, therefore, the direct outcome of the teachings of Darwinian evolution. It was the principles of Darwinian evolution that ruled all his conceptions of biological science. Upon the physical and chemical side of his curriculum there was no talk of evolution. And this regardless of the fact that all those who taught him gave him the assur-

ance that the synthesis of life from the non-living reagents of the laboratory was like to be accomplished at any minute. Despite all this, it must have struck many young men who were beginning their scientific training in the early 'nineties, that Mendeleeff's table of the elements had a strikingly suggestive appearance of evolution about it. Between Huxley's selected zoological types and Mendeleeff's table of the elements there seemed to be an obvious analogy. But evolution, as every medical student knew, was brought about by chance variations acted on by natural selection, and to suppose that such happenings could apply to the inanimate chemical elements was absurd.

Had the young men of the 'nineties not known of Darwinian evolution, but rather had they been nurtured on those "Bridgewater Treatises" written by Whewell and Prout, and on such knowledge of organic evolution as had been possessed by the pre-Darwinian evolutionists, they might have put two and two together and so made a working whole.

As events shaped themselves, there was destined to be a long interval before it was realized that the teachings of the writers of the "Bridgewater Treatises" wove themselves very naturally into the findings of the twentieth century biological chemists.

The Evolution of the Environment.

William Paley had been impressed by the obvious, yet bewildering, suitability of water as an environmental medium for living things; and it is certain that he cannot have been the first to come to this realization and to stand awestruck in the face of this familiar, yet staggering, truth. By Whewell and by Prout and the other authors of the "Bridgewater Treatises" the theme was exhaustively treated; and perhaps we may claim that Whewell seems to be the first man to proclaim in his writings the truth that a just appreciation of the unique adaptation of water to the purposes of life must compel any philosopher to stand bareheaded and appalled in his realization of the fact. Moreover, it was not only in the chemical and physical properties of water that the writers of the "Bridgewater Treatises" saw this astonishing suitability. The nature of the earth, the atmosphere, the alternation of day and night and the passage of the seasons all seemed to demonstrate this extraordinary harmony between the inanimate cosmos and the ordinary requirements of life.

The title of Whewell's treatise was "Astronomy and General Physics Considered with Reference to Natural Theology";[24] that of Prout was "Chemistry, Meteorology and the Function of Digestion"[25]—a seemingly strange combination: but we must remember that William Prout was "the first English physiological chemist." If his pronouncements on natural theology have suffered a somewhat natural eclipse, we must also remember that his discovery of hydrochloric acid in the gastric juice—though "the observations were convincing and clearly described"—has commonly been ignored by subsequent writers. This fact is worth remembering, since of the suitability of the environment as described by Whewell and Prout a more recent writer has said: "It is hard to understand how such ideas could have fallen into oblivion." The understanding is the easier when we remember that the writings of the natural theologists became a closed book when Darwinism was the fashion.

It was the purpose of Whewell and Prout to show in a reasoned and scientific way, and from the facts accumulated in many branches of chemico-physical science, that this was the best of all possible worlds: that somehow the non-living environment had conspired to order a world fit for living things. The thesis was later to be considered as mere fatuous nonsense: but meanwhile it was productive of a vast amount of real scientific speculation and research. Moreover, the trend of thought was, humanly, a satisfying one. As Paley said: "Nor is the design abortive. It is a happy world after all. The air, the earth, the water, teem with delighted existence." It was a happy world; a world in which the inanimate environment had come in a very wonderful way to fit the requirements of living things; and the way in which the fitness had been insured was obviously design—the design of an all-wise Creator.

But such ideas, though appropriate to the early years of Queen Victoria's reign, were destined to be relegated to country vicarages and to pious works intended for the guidance of orthodox youth, when Darwinism swept the Anglo-Saxon world of thought. The doctrines of chance structural variation and natural selection left no room for such ideas. The struggle for existence, the survival of the fittest, and all nature red in tooth and claw, replaced Paley's happy world, of which he exclaims: "What a sum, collectively, of gratification and pleasures have we here before our view!" The struggle of the living thing with the iron demands of an inflexible and hostile environment replaced the coordinated fitness of the animate and inanimate described by Whewell and Prout. Possibly there are still some men who deplore the fact that a theory—termed by a learned contemporary of its advent as a "puerile hypothesis"—should have changed the world of Paley into the world of the post-Darwinians. But the fact remains. The change of thought came with bewildering suddenness, despite the dead weight of conservative ignorance with which the post-Darwinian advocates imagined themselves to be surrounded. The strangely appropriate properties of the environment, which had staggered the authors of the "Bridgewater Treatises," were completely forgotten. Forgotten until, in the twentieth century, they had remarkable new birth. Even today the work of Lawrence Henderson, biological chemist of Harvard, seems to have had but little real recognition from the biologist, the chemist or the physicist; or above all from the ordinary man who cares to be informed concerning the outlook of science upon the meaning of things. Henderson's work was published in 1913 under the title: "The Fitness of the Environment, an Inquiry into the

Biological Significance of the Properties of Matter."[26] In the first place it is to be noted that the word fitness is used in true Darwinian fashion: it is the fitness that has been developed by, and is the outcome of, the struggle for existence. Next, that we may be assured that our author is free from all natural theological bias, it is to be remembered that Henderson, as well as being a staunch Darwinian, is strongly a mechanist—as opposed to being a vitalist—in his outlook upon life. He makes practically only one concession when he writes:

> It appears certain that at least in a few instances and possibly quite generally, purposeful tendencies exist in the organism which seem to be inexplicable by natural selection or any other existing mechanistic hypothesis.

But the concession is not a very generous one, for he proceeds:

> It is not too much to hope that a scientific explanation of these phenomena in whole or in part may some day be found; but meantime they constitute the natural subject of vitalistic speculation. A field remains, though limited, where the physical scientist cannot yet successfully subdue the vitalist, however strong his convictions of the errors of vitalism.

It cannot be urged that these views argue any strong leaning towards the outlook upon nature held by the natural theologists. Nevertheless, the conclusions arrived at are in so perfect agreement with those of these forgotten philosophers that Henderson's work might fittingly have been issued as a supplementary volume of the "Bridgewater Treatises." There is no need to dwell at any length upon the details of chemistry and physics, for these are readily available elsewhere. Of the whole evolutionary range of the nearly ninety known elements it would seem that there has been the election of a very limited number that are capable of forming such combinations as make the whole necessary environment for life as we know it. To follow the story of the elements is almost to be compelled to conclude that there has been a grand conspiracy set afoot to insure that the earth should be a fit habitat for life. It matters little if we follow Henderson in extending a Darwinian type of explanation to the inorganic world, or if we postulate some other method of effecting the evolution, we seem always to be forced to the conclusion that an inorganic evolution has been effected and that it has expressly resulted in fitting the terrestrial environment for the reception and support of life. This fitness is caused by the universal presence of carbon, hydrogen and oxygen, and their compounds, water and carbonic acid gas. Now the strength of the case lies not so much in the fact that these omnipresent substances are competent to form the environment of living things, but that they alone, in the whole range of possible combinations of elements, are capable of providing the external environment in which life, as we know life, could exist at all.

> From the materialistic and the energetic standpoint alike, carbon, hydrogen and oxygen, each by itself, and all taken together, possess unique and preeminent chemical fitness for the organic mechanism. They alone are best fitted to form it, and to set it in motion; and their stable compounds, water and carbonic acid, which make up the changeless environment, protect and renew it, forever drawing fresh energy from the sunshine.

Among the peculiar properties of water that arrested the attention of Whewell as demonstrating its unique fitness in relation to life, were: (i) Its vast quantity as represented in the magnitude of the ocean, (ii) the law and rate of the expansion of water by heat, (iii) the law and rate of the expansion of water by cold below 40°, (iv) the law and quantity of the expansion of water by freezing, (v) the quantity of latent heat absorbed in thawing, (vi) the quantity of latent heat absorbed in evaporation, (vii) the law and rate of evaporation with regard to heat.

The same subject was considered by Henderson under the following heads: (i) specific heat, (ii) freezing point, (iii) latent heat of fusion, (iv) latent heat of vaporization, (v) vapour tension, (vi) thermal conductivity, (vii) expansion before freezing, (viii) expansion in freezing, (ix) solvent power, (x) dielectric constant, (xi) ionizing power, (xii) surface tension.

Now the extraordinary fact emerges that it is the display of these very qualities, as manifested by water, that constitutes an optimum for the support of life; but still more remarkable is the fact that in all these regards the properties of water are in character or in magnitude either unique or nearly so. An analysis of the peculiar properties of carbon dioxide shows the same facts—their essential suitability to life and the uniqueness of their occurrence. With carbon, hydrogen and oxygen and the enormous range of their various compounds, the same facts hold true—their properties are the best possible in relation to life and they alone possess them. Now what conspiracy was it that resulted in the omnipresent begetting upon the earth of carbon, hydrogen and oxygen, instead of, say, lithium, bromine and mercury or any other three elements and certain of their compounds that would have created an environment in which life could neither develop nor be maintained? For it is admitted that no other chemico-physical environment than the one that actually surrounds us, can be conceived as being suitable to life. It is, of course, useless to allude to the process by which this was brought about as a conspiracy. We seem to be driven to the supposition that it was an evolution of the inorganic somewhat akin to the much-discussed evolution of the organic. It appears that perhaps those older philosophers had some justification after all for regarding the stairway of nature as being a whole, from hydrogen to humanity. Maybe they also had some proper reason for imagining that a common influence might act upon the whole and so transform it into a moving stairway.

Now it is obvious, despite the fact that Lawrence Henderson made much use of the parallel of organic evolution upon Darwinian lines, that no sort of Darwinian explanation can be extended to inorganic evolution. Darwinian evolution of the organic is directed to the adjustment of one factor (living

things) to another factor (the inorganic environment) that is ever present and long established, and, by virtue of these conditions, in a position to demand and exact adaptations from life. The whole theory of natural selection presupposes the ancient presence of the inorganic environment to exert its natural selective force upon later developed life. It seems to be clear that no hypothesis anything akin to this can be invoked to explain the transformations of the inorganic world at the time when such an evolution was essential, since the whole evolution was directed towards a fitness for conditions that did not at that time exist. These are certainly those who are prepared to admit that possibly life may be as old as matter itself: but from the very little that is definitely known concerning the origin of terrestrial life, there is every reason to believe that the advent of life was a comparatively late event in the thousand million years or so that embrace the earth's history. If this is so, then the evolution of the inorganic, that seemed so definitely to conspire towards creating a suitable environment for the organic, cannot have been determined by the demands of the yet unborn life. By what was it determined? The guesses must necessarily be strictly limited and, at best, they must rank as no more than guesses. Was it by chance? The chances against the selection of the particular elements and combinations that, essential to life, have become omnipresent, seem to be of such an order of magnitude as to prohibit our credence.

Probably we may get some insight into what kind of answer must, of necessity, force itself into the human mind, if we quote the conclusion of Lawrence Henderson, a scientist who, as we have noted, leans towards a mechanistic interpretation of life and a Darwinian explanation of organic evolution. "Logically," says he in his summing up, "in some obscure manner, cosmic and biological evolution are one. In short, we appear to be led to the assumption that the genetic or evolutionary processes, both cosmic and biological, when considered in certain aspects, constitute a single orderly development that yields results not merely contingent, but resembling those which in human action we recognize as purposeful. For undeniably, two things which are related together in a complex manner by reciprocal fitness make up in a very real sense a unit—something quite different from the two alone, or the sum of the two, or the relationship between the two. In human affairs such a unit arises only from the effective operation of purpose."

So here again we have arrived, as we did from the consideration of organic evolution, at a stage at which we are thrust back upon something that we can only term purpose in the ordering of things.

Previously we used the term purpose as practically a synonym of function: but now the connotation seems to have changed somewhat and purpose becomes almost a synonym for design. We are dangerously near that current of thought that leads ultimately to the gentle stream of the "Bridgewater Treatises."

The Newer Outlook.

We have now arrived at a stage of thought from which all the dictates of scientific prudence should prompt us to withdraw, Nevertheless, the development of this line of thought has seemed to be so natural and to be so inevitably forced upon us by the evidence of facts that it is difficult to turn back.

For this reason and also, perhaps, because we have already gone beyond the limits of scientific caution, it may be well to follow the trail still further.

Although it may not be greatly disturbing, as an intellectual adventure, to entertain the idea that what we have termed a conspiracy has been at work among the inorganic elements to create a habitat fit for living things upon this earth, we may not logically leave the matter simply by considering the elements.

Even when we limit our inquiries to no more than the peculiar properties of water, we find that one of its most remarkable qualifications for affording a fitting environment for the maintenance of life is its unique behaviour when freezing and thawing. If ice did not expand and float upon the surface of water, then, at the very least, aquatic life would be at an end in higher latitudes; and here, at once, the question of the seasons is involved.

So again, in the study of carbonic acid gas, there comes the question of the alternation of sunlight and darkness, and now the rhythm of night and day is brought into the question.

Now it seems, at first sight, that there is a great difference between the passive acceptance of some terrestrial conspiracy of the inorganic elements to produce an environment suitable for life, and any presumptuous belief that the ordering of day and night and the procession of the seasons could also be involved in the conspiracy.

The one supposition demands no more than a belief in a purposeful evolution along the line of the *échelle des êtres*; the other necessitates the assumption that the ordering of the movements of the solar system is also involved in the same conspiracy and is directed towards the same end. This is an assumption that anyone, with any regard for scientific prudence, is apt to shrink from. Yet there are those who have not entertained any doubts as to its truth.

It must have struck many of a later generation, as doubtless it must have impressed many of Paley's own contemporaries, that he had no diffidence whatever in invoking most cosmic processes in the beneficent design of his biocentric universe. Some of us may have felt a certain distaste for this part of Paley's work, since his calm assurance of the designing of the universe for the maintenance of life—and especially human life—seemed to lack proper scientific humility, even if it attested to a great faith. His declaration that "it is not for man, either solely or principally, that night is made," appears to be so shockingly grandiose that it amounts in the one outlook to positive blasphemy and in the other to sheer nonsense. It were better

to embrace whole-heartedly the inane sentiments of certain well known hymns, or alternatively to side at once with what Langdon Davis terms "the village atheist," than to dally with a scientific thesis which held that the movements of the heavenly bodies and the resulting phenomenon of day and night had any relation whatever to animal life on the earth, or in last resort to man himself.

But Paley entertained no doubts upon the matter. He is forthright in his summing up, for he declares that:

> If this account be true it connects the meanest individual with the Universe itself: a chicken roosting upon its perch with the spheres revolving in the firmament.

Should we decide that this summing up is not rightly to be dismissed as mere grandiose imagining, two thoughts must inevitably come from its consideration. Surely Francis Thompson, the poet, saw the same light; and is it not the light that some of the newer physicists are seeing rather more dimly?

But, although Paley, the authors of the "Bridgewater Treatises," Lawrence Henderson and the writers of the new physics school seem, in many ways, to be groping towards the same ends, there are many adjustments to be made before harmony may be attained. And it is likely enough that, if we could reach that harmony, we should find that a poet had been before us in the quest.

There are adjustments to be made from both sides; for maybe the biologist has had an imperfect conception of the universe and the physicist an incomplete realization of life.

When Henderson made clear the apparently purposive evolution of the non-living in preparation for the advent of the living, he pictured the process as being capable of wide extension throughout the universe. Suppose that, by some flight of fancy, we could picture the solar system as being involved in a conspiracy for producing an environment suitable for life, could we extend this picture to embrace the whole universe? The keynote of Henderson's work in this regard may be realized by the quotation of no more than two sentences.

> On the whole of the common-sense judgment that the solar system may be taken as a fair sample of the universe, and that its probable evolution is in the main typical of cosmic evolution in general seems to be well founded.

And again:

> In short a possible abode of life not unlike the earth apparently must be a frequent occurrence in space.

But the question arises: Is the solar system a "fair sample of the universe"? If it is, then, with Henderson, we might possibly regard the whole universe as being involved in a great conspiracy to produce life.

But the writers of the new physics school will apparently have nothing to do with any such thesis. According to Sir Arthur Eddington "the solar system is not the typical product of development of a star; it is not even a common variety of development; it is a freak." Life then appears to have evolved upon an inconsiderable portion of an inconsiderable system which is in its very nature only a freak development within the universe. Eddington's statement is largely founded upon the work of Sir James Jeans, and his conclusions are therefore worth quoting in full. "Life," says Jeans, "can only exist inside a narrow temperate zone which surrounds each of these fires (stars) at a very definite distance. Outside these zones life would be frozen; inside it would be shrivelled up. At a rough computation these zones within which life is possible, all added together constitute less than a thousand-millionth part of the whole of space. And even inside them, life must be a very rare occurrence, for it is so unusual an accident for suns to throw off planets as our own sun has done, that probably only about one star in one hundred thousand has a planet revolving round it in the small zone in which life is possible."

Evidently, if these things are so, the solar system, rather than being "a fair sample of the universe," as Henderson assumed it to be, is something that, humanly speaking, may be said to be unique in the universe. There is, perhaps, a loophole to be found in Eddington's sentence: "However doubtful this conclusion as to the rarity of solar systems may be, it is a useful corrective"; but possibly we should not take advantage of this admission.

It is better to acknowledge that the biologist has failed to realize the staggering disproportion between the immensity of the universe and the utter minuteness of that portion of it capable of being the abode of life in any form.

But if the biologist has failed to realize the immensities of the universe when expressing his admiration for the terrestrial adjustments of life, I think it is also true to say that the up-to-date astronomer has failed to realize the immensities of life when expressing his conception of the vastness of the universe. No biologist could cavil at a physicist or a chemist insisting that life is no more than a mechanism. Quite possibly such an opinion is the correct one and many biologists accept it as such; though there are some, who are essentially students of the living, who do not hold this view. In the wider outlook, the question of mechanism or vitalism is hardly involved; but this is not to condone a failure to appreciate the complexities of life.

Sir James Jeans lays especial stress upon the paramount importance of carbon in all considerations concerning life, and here, of course, he is necessarily in the company of every biologist. He especially points out that the essential structure of "the atom of carbon consists of six electrons revolving around the appropriate central nucleus, like six planets revolving round a central sun." The argument is continued by showing that elements with 26, 27 and 28 electrons are those that exhibit the phenomenon of permanent magnetism; and that those with from 83 to 92 electrons exhibit the phenomenon of radio-activity.

So much for the ordinary ascertained facts of the atomic structure of elements and their correlation

with physical properties. But the argument is continued:

> Thus chemistry can only tell us to place life in the same category as magnetism and radio-activity. The universe is built so as to operate according to certain laws, atoms having certain definite numbers of electrons, namely 6, 26 to 28, and 83 to 92 have certain special properties, which show themselves in the phenomena of life, magnetism and radio-activity respectively.

But is this true? Certainly elements with atoms having from 26 to 28 electrons manifest the phenomenon of magnetism and those with from 83 to 92 electrons manifest the phenomenon of radio-activity. But does that which has 6 electrons manifest any of the phenomena of life? Were carbon, as an element, to be alive or to show any manifestation of the phenomena of life, the argument would certainly be a valid and a very striking one. It would necessitate us taking a very simple view of that which we have always assumed to be a matter of considerable complexity. But until the new physicist can show us "life" in carbon, as he can magnetism in iron and radio-activity in radium, we must regard his deductions concerning the simplicity of life as being somewhat ill founded.

Carbon, with its peculiar chemical and physical properties, is one of the essential constituents of that complex chemico-physical entity in which the phenomena of life can alone be manifested; but to say that the element carbon manifests the phenomenon of life, as the element iron manifests that of magnetism, is absurd. Nor indeed is it any chance member of the whole vast range of the compounds into which carbon enters that is alive. It is only protoplasm, and then only living protoplasm, in which the properties of life reside.

No speculations of the new physics, in which it is assumed that life is a thing of much the same order as magnetism, can make appeal to the biologist, any more than the assumption of the biologist that life might be widely distributed throughout the universe can win the approval of the physicist. We stand in need of a synthesis of thought and in this synthesis due recognition must be made both of the vast complexity of the basis of life and of the infinitesimally trifling place it seems to have in the general scheme of the universe.

Seeing Life Whole.

In speaking of those we have called the big, simple men, we took liberties with a poet. It was Sophocles of whom the poet said that he was one "who saw life steadily, and saw it whole": but I fancy there is no injustice done in extending this dictum from Sophocles to those other big simple men whose conceptions of life we have, in some measure, attempted to understand.

The merit of all these lies, as we might say, in the breadth of their outlook or as the poet, with a finer sense of the values of words expressed it, in seeing life whole.

Now if we look over the restless activities and the searchings of the present day intellectual world, we may possibly detect, amidst all the manifold experiments and adventures, a common motive prompting all those quests that are productive of the best efforts of modern intellectual activity.

If we stated this motive to be no more than a revolt against analysis, we should greatly underrate both its scope and its urgency. If, on the other hand, we defined it as an intellectual stand for an all-embracing *Gestalt* philosophy, we should tend to confine to academic limits a thing that far transcends any such boundaries. Even if we say that all forms of intellectual activity are seeking an escape from the narrow confines of tradition by an attempt to see things whole, we fall far short of a proper definition of what is perhaps one of the greatest of intellectual movements.

A musical note isolated from those that come before and after it in the melody of which it may form a part, a word divorced from its context, a tree or a figure considered apart from its setting, an organ removed from the body of which it is a constituent, an organism separated from its environment, are utterly different from the same things when considered in their proper setting as a whole. Some such jumbled statement may help to convey an idea. The musician must regard the melody as a whole, the painter the whole composition; the biologist must try to see, not only the whole organism, but must regard this organism in its whole natural setting. Might the human philosopher ever aspire to seeing the universe whole?

Schools of thought and fashions of various kinds arise in music, art, literature and in every other intellectual sphere; but in the end are not all those gropings which are destined to win to some finality in truth, founded on this appreciation of "wholeness"? In the wide range of intellectual activities, it is certainly not always the most appreciated nor the most successful schools that have held steadily to this conception of wholeness; nevertheless such as have had this guiding light have ever been creative. Should search be made among the painters, or the poets, or among any other group of those who have attempted to interpret things, it will be found that those who have come nearest to truth, those who have achieved permanent and creative work are those who have especially held fast to this ideal of seeing things whole. What has become known as a little labled thesis of philosophical psychology (the *Gestalt* theory) is in reality the great intellectual quest of all mankind. We all—if we are to understand anything in the intellectual sphere which we especially cultivate—must try to see things steadily and see them whole.

With so much by way of prelude we may return to the findings of the newer astronomy.

As Sir James Jeans puts it:

> We find the universe terrifying because of its vast meaningless distances, terrifying because of its inconceivably long vistas of time which dwarf human history to the twinkling of an eye, terrifying because of our extreme loneliness, and because of the material insignificance of our home in space—a millionth part of a grain of sand out of all the sea-sand in the world.

Here, apparently, is an end to all our dreams. If earth alone is the abode of life, as we know life, we could not readily suppose that all the sea-sand in the world had come into existence merely that on one-millionth part of one grain of it something should develop. It is true that Eddington offers us rather more hope when he writes:

> We know the prodigality of Nature. How many acorns are scattered for one that grows to an oak? And need she be more careful of her stars than of her acorns? If indeed she has no grander aims than to provide a home for her greatest experiment, Man, it would be just like her methods to scatter a million stars whereof one might haply achieve her purpose.

The biologist is not accustomed to thinking in millions, but surely there is some latitude displayed by the astronomer in the handling of these vast figures. Even to the biologist there must appear some difference in magnitude between one star in a million being fitted for life, and the one-millionth part of a grain of sand out of all the sea-sand of the world which, according to Jeans, earth represents. Upon Eddington's parallel of the prodigality of Nature in regard to acorns, and of the many others of its kind that could be cited, it might well be conceived that a proportion of one star in a million might fall within the limits of Nature's prodigality in this matter of providing a home for life. But when we consider even one grain of sand in all the grains of sand on all the sandy beaches of the whole world (and thereby increase the chances a millionfold) the thing becomes difficult to credit. Nature knows no scattering of acorns upon this appallingly prodigal scale.

What, then, is left to us? Though we might be led by a series of apparently sound arguments to suppose that the solar system had been involved in a conspiracy, or had been part of a designed scheme, for providing at least one proper habitat for life, the mind revolts from carrying the matter further and supposing the universe to be concerned with so inconsiderable and so freakish a thing.

Perhaps this is only to say that in dim fashion we are able to see things whole until we reach the magnitude of the solar system, but beyond that the wholeness is outside our intellectual grasp. And yet maybe there is a wholeness that one day may be appreciated by the human mind.

An atom is a very small thing. "In a tiny grain of dust there are some thousand million million atoms."[27] No one may hope that the atom will ever be made visible; and yet its structure is now well known. When dealing with the atom of carbon we quoted Jeans as saying that it "consists of six electrons revolving around the appropriate central nucleus, like six planets revolving round a central sun." In the structure of the atom the least imaginative of mankind may recognize a similarity of design to that manifested in the solar system. And so, from the inconceivably little to the incomprehensibly large, from the atom to the molecule and to the solar system and onwards by way of the myriad nebulæ to the universe itself there seems to be an underlying unity of design. Here is something gained. A thousand million million atoms gathered together may bulk no larger than a grain of dust. The millions of millions of nebulæ occupy space so great that fifty million light years separate even the nearer star clusters from us. Both the extremely little and the extremely large are so far beyond our comprehension that no human mind may see wholeness in it all; but an approach to wholeness may lie in an appreciation of the apparent underlying similarity of design that seems to stretch from the atom to the universe.

Possibly the ultimate chemico-physical condition that makes life a possibility is the vast number of atoms that are aggregated into its complex molecule. Whilst the atom of carbon may aptly be likened to the solar system, the chemico-physical basis of life resembles a universe in little. On the side of the infinitely little we seem to be able to see a development that is purposive. We witness the formation of the complex universe of the molecule that constitutes the chemico-physical basis of life—and one of the attributes of life we have postulated to be that it is itself essentially purposive. On the side of the infinitely large we seem to be able to follow the development of purpose as far as the ordering of the solar system, which we might postulate as the cosmic equivalent of an atom. Beyond that it does not seem permitted for the human intellect to perceive wholeness. We lose the thread at the cosmic atom, the cosmic molecule is beyond us, and far, far outside our comprehension, is the cosmic organism in which, by analogy with the little, cosmic life and purpose and mind may be manifested.

We are as the cheese mites who considered the cheese. It may be that we can extend our conception of wholeness to embrace our cosmic cheese, and maybe go a little beyond this. Nevertheless, like the mites, no one of us can conceive of the cow: that is altogether outside our imagining in any picture of the whole.

It used to be said that when some explorer should first win to the North Pole he would surely find on his arrival that he had been anticipated in his quest by a Scotsman and a bottle of whiskey. This prophetic utterance may have been shown to be untrue, nevertheless, I still cling to the belief that whoever wins to a great scientific truth will find a poet before him in the quest.

Probably it is not given to the human mind to see things whole when the infinitely large—the universe itself—is considered. Paley dared greatly when he ventured to suggest, in sober prose and in a work of scientific intent, that his conception of wholeness connected "a chicken roosting upon its perch with the spheres revolving in the firmament." But surely the poet has outdistanced us all. It was Francis Thompson who wrote:

> All things by immortal power,
> Near or far,
> Hiddenly
> To each other linked are,
> That thou canst not stir a flower
> Without troubling of a star.

No new physicist, no biologist, has so far given us a concept of organism so completely satisfying as this: and when the Einstein of biology is achieved it is likely he will give us his dictates in a scientific jargon that will mean no more than Francis Thompson's revelation in his "Mistress of Vision."

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Reports of Cases.

NOTES ON A FURTHER CASE OF FAMILIAL JAUNDICE.

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IN THE MEDICAL JOURNAL OF AUSTRALIA of September 28, 1929, I published "Notes on a Case of Familial Jaundice," being the particulars of a patient who had been in my care. I should like to report the progress of a later pregnancy of the same woman, together with notes of the work done in attempting to break the long series of infantile deaths from this disease.

Mrs. T.M., aged thirty-nine years, consulted me on August 28, 1930, being then about three months pregnant. It is necessary to recapitulate her previous history in order to maintain the continuity of the reports. Married at twenty-two years of age, her first child was born within twelve months. This child and the second child, another female born eighteen months later, have remained perfectly healthy and show no evidence of any abnormality whatever, being well grown, strong and healthy girls. The third child, a male, born in January, 1917, developed jaundice on the third day, got worse and worse, and died on the ninth day. She had a still-born premature male infant at the latter end of 1918. In September, 1920, a male child was born, developed jaundice on the third day, and died on the fifth. Another male child, born in November, 1922, developed a severe jaundice on the second day and died on the third. In April, 1924, a female child survived for eleven days, for nine of which she was suffering from a progressive jaundice. The eighth child, born in September, 1926, developed jaundice on the second day and died on the third day after birth. The ninth child, the case reported by me in September, 1929, lived for eight days.

An examination of her blood, carried out on November 7, 1929, showed that the blood picture was absolutely normal. Immediately on reporting to me, she commenced a series of blood examinations, carried out by Dr. R. Y. Mathew at the Commonwealth Health Laboratory, Toowoomba. This involved a journey of over one hundred miles each visit, and this trying journey was the only reason why more tests were not carried out. The results of the tests are shown in the attached tables. Following upon the suggestions of Kugelmass and Tritsch[1] her diet was so arranged as to contain as much as possible of varied proteins and varied lipins. Visceral organs, brains, kidney, pancreas and liver (I forbore to ask the woman to consume quantities of lung and testes, the two most highly recommended organs) were taken constantly and regularly, fresh as often as was possible, and in a dried form, or as extracts, when fresh glands could not be obtained. In addition, fresh fruits and vegetables and a proprietary preparation stated to contain a large quantity of vitamin *B*, and also lime salts were regularly consumed. This diet was maintained to the best of the ability of the patient, consistent with living on a small farm, fourteen miles from a township, through a hot summer. The patient felt and looked well during the whole of the pregnancy and nothing untoward was noted on any of the many visits made to me. The excretory organs acted well and the urine remained clear throughout. As may be noted from the tabulated blood examination notes, there was an increase in the fragility of the erythrocytes toward the latter end, but otherwise the blood maintained a normal level. In consultation with several of my colleagues it was decided that it was reasonable to prevent further pregnancies, as the mental strain, apart from the physical one, was making itself obvious in the patient's nervous system. At the same time further interesting facts were brought under my notice by Dr. Mathew.

An editorial on *icterus neonatorum* in *The Journal of the American Medical Association*[2] gives some information on recent work in this important subject. Statistical tabulations are stated to place the incidence of *icterus neonatorum* at from 20% to 80% of all normal new-born infants. Reference is made to the introduction of the Van den Bergh test and the possibility of distinguishing between a jaundice of an obstructive and a non-obstructive type, the main essential difference being that the bilirubin has been subjected to the action of the liver cells in the first type and that such subjection has not occurred in the second type. The editorial states further that the erythrocyte count of new-born infants is high as compared with children and adults, and apparently the mechanism of delivery initiates changes in the body of the infant that lead to destruction of erythrocytes and to the formation of bilirubin from their derivatives by the reticulo-endothelial system. Observations by Goldbloom and Gottlieb[3] at McGill indicate a rapid decrease of this polycythæmia after birth. The decrease in the number of red cells is stated to begin during the first twenty-four hours after birth and to reach its maximum within the first week of life, the erythrocyte count becoming stabilized by the latter half of the second week. *In vitro* tests proved the fragility of the red cells to be greater during the period of decreasing polycythæmia than later. Goldbloom and Gottlieb present a plausible explanation of the polycythæmia of the new-born infant and its rapid disappearance. Because of the nature of the fœtal circulation the fœtus lives in a state of relative anoxæmia, a state which, as in post-natal life, demands a high number of erythrocytes for the transport of the available oxygen. With the establishment of a separate arterial and venous circulation at birth the necessity for the polycythæmia disappears and the more immature and more fragile red cells disappear from the blood. Their destruction leads to a physiological hyperbilirubinæmia that may manifest itself as visible jaundice.

TABLE OF EXAMINATIONS OF BLOOD.

Investigation.	Date of Examination.			
	5.9.30	21.11.30	22.12.30	15.1.31
Hæmoglobin value (Haldane)	82%	85%	88%	90%
Red cells	5,200,000	4,800,000	4,600,000	4,800,000
Colour index	0·9	0·8	0·8	0·8
White cells	9,800	6,100	8,700	7,600
Film	Red cells no abnormality detected. Few platelets.	Red cells no abnormality detected. More platelets.	Red cells no abnormality detected. Scanty platelets.	Red cells no abnormality detected. Scanty platelets.
Differential count:				
Polymorphonuclear cells	61%	74%	65%	70%
Eosinophile cells	1%	—	1%	—
Lymphocytes	34%	21%	28%	23%
Transitional cells	4%	5%	6%	7%
Reticulocytes (brilliant cresyl blue)	—	Occasional	—	—
Coagulation time	4 minutes	2½ minutes	2½ minutes	2½ minutes
Bleeding time	—	1½ minutes	1½ minutes	1½ minutes
Fragility test:				
Hæmolysis in 0·3% sodium chloride	+++	++	+++	+++
0·35% " "	++	+	+++	+++
0·4% " "	+	—	++	++
0·45% " "	—	—	+	+
0·5% " "	—	—	—	—
Van den Bergh test	No reaction	Direct — Indirect, faint +	Direct — Indirect, faint +	Direct — Indirect —
Fouchet test	No reaction	Faint +	Faint +	No reaction
Calcium content per 100 cubic centimetres serum	9 milligrammes	11 milligrammes	9 milligrammes	10·5 milligrammes
Blood sugar	—	0·10% glucose	0·085%	0·09%
Liver function test (Levulose)	—	Before, 0·10% After 1½ hours, 0·09%	—	—
Blood urea per 100 cubic centimetres blood	—	—	20 milligrammes	20 milligrammes

Wassermann test with both parents gave no reaction.

With the object of preventing this polycythæmia in the infant which is stated to occur just prior to birth, and, therefore, of obviating the necessity of a wholesale erythrophagocytosis to reduce the erythrocyte count to normal soon after birth, it was decided to assist the child into the world by Cæsarean section and so reduce the strains and stresses on the child to a minimum. It was felt that opportunity should be accepted of preventing further pregnancies by salpingectomy, and it was considered that the risk to the mother was not much greater than in an ordinary labour and subsequent section, while the child would obtain the benefit of relief from one of the important causes of jaundice in the new-born.

Cæsarean section was performed at 9 a.m. on February 14, 1931, seven days before labour was due. A female child, weighing three kilograms (six pounds seven ounces), was delivered without difficulty, the cord being clamped a few moments after birth, the placenta separating almost immediately afterwards. Resection of a portion of each tube was carried out before suturing the abdominal wound. The maternal blood clotted readily and was normal in appearance to the naked eye.

The infant appeared to be perfectly well for twenty-four hours after birth, when it began to be drowsy, and an icteric tinge occurred on the palms and soles. This spread rapidly, so that at the end of forty-eight hours an intense jaundice was present. The child died at the end of seventy hours of extrauterine life. The mother had a normal puerperium and remains well.

With a view to completing his valuable assistance in this case, Dr. Mathew made it convenient to be present at the time of operation and collected specimens of blood from the infant shortly after birth, also from the cord, which was clamped at either end just prior to separation of the placenta. His report on these two specimens is appended here.

Infantile Blood.

Red cells, 4,800,000 per cubic millimetre.

Film: The red cells were normal in appearance. Great numbers of nucleated red cells were present. White cells were not abnormal.

Fragility Test: Hæmolysis occurred in 0·35% saline solution, but none in 0·4%. This does not indicate any increased fragility of red cells.

Blood from the Cord.

The calcium content was 10·7 milligrammes per 100 cubic centimetres of blood. The Van den Bergh test gave a negative direct reaction and a positive, indirect reaction. The Fouchet test gave a faintly positive reaction. The Wassermann test gave no reaction.

Dr. Mathew writes:

> The blood from the cord on clotting consisted of about equal parts of serum and clot. The serum was faintly bile tinged. The only points which we seem to have got any further information on are that the dieting and treatment during pregnancy were of no avail in Mrs. T.M.'s case, and that the tests we did during the pregnancy gave no information of value in regard to the prognosis of the baby.
>
> I have since made similar examinations of the blood of four healthy non-jaundiced babies within six hours of birth. Three were bile-tinged and all gave an indirect reaction to the Van den Bergh test. It would seem that in the case of Baby T.M. the bile in the blood at birth is not necessarily due to the same cause as the deepening jaundice after birth.

Summary.

1. The case is reported as a sequel to one previously reported, occurring in the same family, and being one of familfal (hæmolytic) jaundice, one of the lesser known forms of hæmorrhagic disease of the new-born.

2. Of ten children born the first two have remained healthy, one was still-born, and seven have succumbed to the disease.

3. The cause of the jaundice appears to be definitely established as being due to breaking down of erythrocytes immediately after birth, with the formation of bilirubin from the hæmoglobin content of the destroyed erythrocytes.

4. Inasmuch as the infantile red blood corpuscle count was normal, it would appear that at least one cause of the disease, that is, the usual erythropolycytosis occurring immediately prior to labour was eliminated by early Cæsarean section. This assumes that the work of American observers in this respect is accepted.

5. Though unsuccessful in this case, with hospitalization during the whole term of pregnancy and proper supervision and maintenance of regulated diet it may be possible to produce the conditions necessary for the birth of a healthy child.

6. Ordinary conditions of life, such as prevail in the country districts of Australia, do not seem to be sufficient to achieve this object.

Acknowledgement.

I am greatly indebted to Dr. R. Y. Mathew, of the Commonwealth Health Department, for his unfailing help and care in making the examinations of the patient's blood.

References.

(1) I. N. Kugelmass and J. E. Tritsch: *The Journal of the American Medical Association*, Volume XCII, February 16, 1929.
(2) Editorial, *The Journal of the American Medical Association*, Volume XCV, December 6, 1930.
(3) Goldbloom and Gottlieb, quoted in the Editorial *loco citato*.

Reviews.

FORENSIC MEDICINE.

THE fact that Professor Glaister's "Medical Jurisprudence and Toxicology" has reached its fifth edition speaks for itself.[1] The author has been a teacher for almost half a century and has in this edition the assistance of his son, Professor John Glaister.

There is a personal touch derived from long experience which distinguishes this book from a mere compendium of the subject.

As practically all medical men must at some time be brought in contact with the law in its relation to medicine, this volume can with confidence be commended to the profession. All the younger members of the profession should read it, and they can be assured not only of the necessary instruction, but also of fascinating interest. The articles on malpraxis, skiagraphy, medical evidence, medical testimony in court, death under anæsthetics and abortion are worthy of study by everybody. We regret that under abortion there is no reference to sudden death from so-called air embolism. In Sydney several undoubted cases of sudden death from this cause have been recorded. We can heartily recommend the book for the library of all medical men and senior students in both law and medicine.

ASTHMA AND ITS TREATMENT.

THE title, "The Treatment of Asthma," of the book by Dr. A. H. Douthwaite, of Guy's Hospital, is not altogether descriptive of its scope.[2] As mentioned in the preface, treatment depends upon cooperation between physician, specialist and biochemist. Thus the author deals first with many features, clinical, bacteriological and metabolic, of this widespread complaint, and the following systematic discussion of treatment based on physiology, pathology and biochemistry is both convincing and interesting.

A very wide field is covered in this small book, and an excellent list of references supports most of the recent work of note on the subject in the past few years. From the chapter describing the paroxysm, in that dealing with investigations, and throughout those on treatment we find many condemnatory references to the operative zeal of many nose and throat surgeons. In his experience "to find an anatomically perfect nose is rare, and variations such as deflection of the septum, though worthy of note, should never give rise to great hopes of having discovered an important pathological feature." He admits the possible importance of infected sinuses, but in the final chapter containing a summary of results of treatment quotes authorities to support his view that whilst as many as 44% of patients showed nose, throat and dental infection, these foci bore "little relationship to the outcome of asthma," and that the gross results of interference were disappointing. He is not dogmatic; his plea is for greater cooperation, as is surely indicated by figures showing nearly 30% of patients "having had nose and throat operations without regard to the cause of the asthma as found." Even psychotherapy claims attention in some cases. "Many asthmatics are of neurotic temperament and family history." We are glad that the author does not support "the extravagant claims which have been made for the value of psychotherapy in the treatment of asthma." He quotes this as another instance of what he calls the "greatest danger to the asthmatic, that of falling into the hands of the specialist in the first instance." These are his strongest criticisms. He writes, as he states, "without bias or dogmatism as far as possible." We note that he admits stressing the value of physiotherapy, owing to considerable personal experience therein. He deals mainly with massage and respiratory exercises, and we wonder, after noting his detailed description of this treatment as practised at Guy's Hospital, whether it is not entirely neglected in Australia, even at our larger teaching hospitals.

Altogether it is an excellent *résumé* of the present state of our knowledge of the subject from the time-honoured asthma powder and proprietary inhalations to the recent work concerning allergism and urinary proteose.

[1] "A Text-book on Medical Jurisprudence and Toxicology," by John Glaister, M.D., D.P.H., F.R.S.E., and John Glaister, Junior, M.B., Ch.B., M.D., D.Sc.; Fifth Edition; 1931. Edinburgh: E. and S. Livingstone. Demy 8vo., pp. 969, with 132 illustrations and seven plates. Price: 30s. net.

[2] "The Treatment of Asthma," by A. H. Douthwaite, M.D., F.R.C.P.; 1930. London: H. K. Lewis and Company. Crown 8vo., pp. 164.

Analytical Department.

"MALCOE."

"MALCOE" is manufactured by The Fruit Products Company of Australia, Limited, of Bruce Street, Waterloo, Sydney. It contains malt extract, cocoa, eggs and a small quantity of salt, with sugar and vanilla essence for sweetening and flavouring. Suitably diluted, it is an agreeable and palatable beverage.

A mixture of water, cocoa, invert sugar and eggs is brought to a temperature of 103·3° C. (218° F.) in a steam jacketed pan; the steam is turned off and extract of malt and vanilla essence are added. When the mixture is complete the material is run off through a fine mesh sieve and collected in jars which are loosely capped and placed in a metal box where they are kept under the influence of steam at a temperature of 100° C. (212° F.) for a period of fifteen minutes. They are then finally capped while still hot in a negative atmospheric pressure. There is no handling of the foodstuff at all, the premises in which it is manufactured and the implements and utensils employed are clean, and the materials used are of good quality. The workpeople are clean in dress and appearance.

Samples of "Malcoe" were submitted to our analyst; his report is as follows:

"Malcoe" is a viscous brown fluid of about the consistency of condensed milk. Its solid ingredients are in a very fine state of subdivision and it is a very well made preparation.

Two samples were analysed, one from the factory, the other purchased in the open market.

	I.	II.
Available carbohydrate as glucose	43·40%	43·30%
Ether-soluble extract (fat *et cetera*)	2·10%	2·20%
Crude protein	4·70%	4·79%
Ash	1·04%	1·20%

In addition there was much cellulose and fibrous material in a fine state of subdivision and, of course, water.

Cocoa was present in large amount and the presence of maltose suggested malt extract. The amounts of ether-soluble extract and crude protein indicate that the egg content is low.

"Malcoe" is, then, a well made preparation of cocoa and malt.

"Malcoe" can be recommended as a very pleasant addition to hot milk as a beverage, and for many people would undoubtedly make the milk more palatable.

The Medical Journal of Australia

SATURDAY, AUGUST 29, 1931.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction, are invited to seek the advice of the Editor.

GOOD MANNERS.

DURING recent months many aspects of the ethical side of medical practice have been discussed in the editorial and correspondence columns of this journal. Since medical practitioners have to gain their livings by attendance on the members of the community, and since the motives of medical practitioners and the methods that they would like to adopt for the purpose of attracting the prospective patient are as varied as their characters (both are, of course, dependent on character), it is necessary that there should be some standard or code by which they should regulate their professional lives. The existence of such a code is necessary to the well-being, to the health, to the safeguarding of the possessions of the people, and even to their lives. But ethics is only one side of the picture. The medical profession cannot be effective unless it is united; it cannot be united unless its members live at peace with one another. This aspect has received little attention; and yet it is the groundwork of success. The young graduate goes out into the world full of hope, with the precepts of his teachers ringing in his ears; he now belongs to a profession in which all are brothers and in which he can study disease and work for the good of mankind. He is often completely disillusioned before many moons have passed. The question of money has arisen; personal vanity has to be satisfied; successful mediocrity, like a pouter pigeon, must be allowed to preen its feathers, even if the act be one of self-admiration; wives with social ambitions must be pushed a rung or two up the ladder. And so on. The young graduate may find that even his teachers whom he looked on as exemplars of all the virtues, are little better than others. The fault may, of course, lie with the young graduate himself; more often it does not.

It is most regrettable that it should be necessary to refer to this subject. Time and time again medical practitioners engaged in workers' compensation practice, friendly society lodge practice, hospital practice or private practice are brought up against the most flagrant defaults. Defaulters, like criminals, often become "habitual." There is the so-called consultant who sees another man's patient; the patient obviously has had treatment from someone; the consultant, so-called, advises the adoption of certain remedies, an operation, a course of injections, massage or what not, and the general practitioner sees his patient no more. When this consultant is taxed with alienating a patient from his usual attendant, he replies in a most surprised way that he did not know that Dr. So-and-so was in attendance. Again, there is the "near-suburban" surgeon who has achieved notoriety for fearlessness in operations, more correctly termed "operative interference." This gentleman "never sees patients apart from their medical attendants." When consulted by a patient, however, who, it is evident, has had previous treatment, he is interested and kind, collects his fee and learns casually that Dr. So-and-so is the attendant. He writes a most polite note to Dr. So-and-so explaining the circumstances, but, like the so-called consultant previously mentioned, forgets that he should have made a point of inquiring at the outset whether any one was in attendance. Examples, many of a more blatant type, might be multiplied. Unfortunately, more often than not, especially in workers' compensation practice, the offender is a comparatively senior member of the profession.

The remedy is easily stated; it is much more difficult to enforce. If the rules of the cricket field were applied in the consulting room, there would be no trouble. Pride, vain glory, envy and love of money stand in the way. When a medical practitioner feels that he has been unfairly treated by a colleague he should see the colleague face to face and state his case. Thus will many misunderstandings be explained and many a cloud dispersed. If no conclusion can be arrived at, a repetition of the offence might be the cause of a complaint to the Branch Council of the British Medical Association. The medical profession is in some respects like a family. Tale-bearing without just reason is not to be countenanced in any family and reacts on the teller of the tale. But when there is justification for a complaint and when it is obvious that the rules of cricket make no appeal to the offender, there must be no fear or favour, no mere expression of pious platitudes and no kotowing to seniority. A fault is much more reprehensible in a senior and calls for sterner rebuke. Further, it ought to be made possible to inform other practitioners if one of their number persistently ignores the rules of decent conduct. From such a one the veneer of hypocritical righteousness should be stripped so that all might see him in his naked and native worth.

Current Comment.

ACUTE DISSEMINATED ENCEPHALOMYELITIS AND DISSEMINATED SCLEROSIS.

POST-VACCINAL acute disseminated encephalomyelitis has a mortality rate variously estimated as 25% to 50%. The survivors as a rule recover completely. The same disease may follow "influenza" or such infectious disorders as measles or less often mumps and varicella; it may be spontaneous. Douglas McAlpine gives a review of the disease with its clinical picture and sequelæ; he describes several cases and compares it with disseminated sclerosis.[1] He states that the pathology of all the groups is essentially the same. The lesions are disseminated both in the brain and spinal cord, with equal implication of the white and grey matter. The essential lesion is a perivascular zone of demyelination which may be discrete or of some magnitude. Perivascular infiltration varies greatly; it may even be absent. There may be a broad zone of cells outside the adventitia extending into the surrounding tissue and quite unlike the closely packed "cuff" of epidemic encephalitis. The onset is abrupt. Fever is common in children, but may be absent in adults. Fresh manifestations appear, usually within the first three weeks, but less often for some months. Recovery is usually complete and may be rapid, even when the central nervous system has been severely involved, but some sequelæ may remain. The process is disseminated. In the cerebral type meningeal symptoms may be outstanding. There may be general convulsions and trismus. Stupor, coma, hemiplegia, hemianopsia and aphasia have been seen. In the spinal type pain is early and severe, or there may be numbness or "pins-and-needles." There may be diminution of all forms of sensation below a certain level. Some forms of sensation may be impaired more than others. There may be motor weakness in the lower limbs. Deep reflexes may be absent or, in the lower limbs, they may be increased, wtih extensor plantar response. Sphincter disturbance is the rule. Ataxia in the upper limbs may be unilateral or bilateral. There may be extremely rapid and fine nystagmus as contrasted with the less rapid nystagmus of disseminated sclerosis. Diplopia and optic nerve implication are rare. In cases presenting these features a diagnosis may be made of *neuromyelitis optica*, considered by some to be an entity distinct from disseminated sclerosis. Dysphagia, dysphonia and facial paralysis have been recorded. Changes in the cerebro-spinal fluid are infrequent.

McAlpine reports several cases in detail and discusses the relationship to disseminated sclerosis from clinical and pathological standpoints. He points out that a temperature over 37·8° C. (100° F.) suggests acute disseminated encephalomyelitis. Severe shooting pains are rare in acute disseminated sclerosis, as is also diplopia; both are common in acute disseminated encephalomyelitis. Nystagmus, if present in the latter, is finer and more rapid than in disseminated sclerosis. Retrobulbar neuritis occurs in both, but more often in disseminated sclerosis, in which disease it is generally unilateral. In acute disseminated encephalomyelitis it is usually bilateral. Euphoria is rare in disseminated encephalomyelitis, but common in early multiple sclerosis. In disseminated sclerosis loss of deep reflexes in the lower limbs is rare and sensory loss, when present, generally involves postural and vibration sense. In acute disseminated encephalomyelitis thermal and, in less degree, pain sensibility may be affected and loss of deep reflexes in the lower limbs is not uncommon.

The sequelæ of acute disseminated encephalomyelitis (especially the spinal form) may closely resemble chronic multiple sclerosis, and diagnosis may be determined only by the history of the acute illness. In the absence of a satisfactory history clinical differentiation between the two diseases may be impossible. Some aid may be obtained from repeated examination of the cerebro-spinal fluid. The Lange gold curve is positive in half of the cases of disseminated sclerosis. A repeatedly normal

[1] *The Lancet*, April 18, 1931.

Lange curve might cast doubt on the diagnosis of disseminated sclerosis, but would not positively exclude it. Persistence of abdominal reflexes in the presence of extensor plantar response, diminished deep reflexes, thermal sensory loss, absence of euphoria, presence of muscular wasting and normal cerebro-spinal fluid are findings which make a diagnosis of disseminated sclerosis doubtful if more than one occur together.

Within recent years a form of acute disseminated encephalomyelitis has appeared after vaccination or infectious fevers, or spontaneously, sometimes in epidemic form, and generally with low mortality. The acute period does not often exceed two or three weeks. Rarely relapses may occur during the first few months and various sequelæ may follow. It is believed that in all these groups the same virus is the causative agent. In its later manifestations disseminated encephalomyelitis may closely resemble disseminated sclerosis.

McAlpine makes no reference to intention tremor or syllabic (scanning or staccato) speech in his differential diagnosis. It is quite possible that diseases presenting similar clinical features and pathological lesions are due to totally different causative agents. The organism responsible for disseminated or insular sclerosis has so far eluded discovery. Among others, a spirochæte, different from the *Treponema pallidum*, has been suggested. Chevassut's *Spherula insularis* is looked upon with doubt. The possibility of multiple sclerosis being a deficiency disease—a form of avitaminosis—has also been put forward. Post-vaccinal encephalomyelitis is engaging much research at present. The known facts of this disorder might be explained by the activation of a neurotropic virus or organism by the vaccinia virus. This, however, is not universally accepted. In this regard reference may be made to work by Hurst and Fairbrother on poliomyelitis and vaccinia, mentioned in these pages on July 11, 1931. Acute anterior poliomyelitis and lethargic or epidemic encephalitis are different diseases with different causal organisms. In the light of existing knowledge disseminated encephalomyelitis and disseminated sclerosis must be regarded as distinct entities. Probably the bacteriologist will be the final arbiter.

PLACENTAL HORMONES.

IN THE MEDICAL JOURNAL OF AUSTRALIA of April 25, 1931, reference was made to some work by J. B. Collip, D. L. Thomson, M. K. McPhail and J. E. Williamson on placental hormones. The effects of extract of human placenta were noted on the growth and weight of the ovaries, testes, seminal vesicles, prostates and epididymes of immature and adult rats; these effects were compared with those obtained by implantation of pituitary glands. Campbell and Collip have reported further clinical studies on what they call the "anterior pituitary-like hormone" of the human placenta.[1]

[1] *The Canadian Medical Association Journal*, July, 1931.

It has been shown that alcoholic extracts of the human placenta can be separated into three definite fractions, each of which has distinct physiological properties. Campbell and Collip have previously found that the first of these fractions, emmenin, has no appreciable beneficial effect in the treatment of menorrhagia and metrorrhagia. Their present investigation has been made with the second fraction and the patients comprised forty women who were suffering from menorrhagia and metrorrhagia. The findings in each instance are given by means of graphs and the authors point out that it is impossible to obtain correct quantitative data in regard to the amount of uterine hæmorrhage. They have given no special name to the extract used; the name "anterior pituitary-like" has been shortened to "A.P.L." The amount of extract injected was one to two cubic centimetres every day or every two days for varying periods. The amount of active principle used is thus small, if the human subject be compared on the basis of weight with the rat.

Campbell and Collip enumerate their "impressions" at the end of the clinical histories; they are to be commended for avoiding the word conclusions. They found that in menorrhagia of the simpler types treatment for one week before the onset of the flow materially reduced its amount. They think that menorrhagia of the more severe type may require treatment for three months or longer before normal periods are established. As far as metrorrhagia was concerned, when the continuous uterine bleeding was partially controlled, the same tendency to the establishment of normal cycles as in the patients with menorrhagia, was not observed. They found that when curettage of the uterus was carried out, the duration of treatment was much shortened. In some instances cycles dated from a period of metrostaxis of one to five days' duration which occurred ten to eighteen days following the onset of the previous period of excessive uterine bleeding. In none of the patients was any enlargement or engorgement of the breasts seen.

In their discussion Campbell and Collip state that until there is more definite knowledge of the underlying causes of menstrual disorders it is useless to theorize further. The physiological effect of the active principles of certain tissues is being discovered, but a knowledge of the physiology of any of the hormones does not help us to understand the exact manner in which the active principles interact. The exact way, therefore, in which an active principle of placental origin may restore to normal health a woman who is suffering from excessive menstrual bleeding, must remain a matter of conjecture. These statements should be borne in mind by medical practitioners who propose to use hormonal extracts in the treatment of patients. Treatment must at present be largely empirical as far as the use of hormonal extracts is concerned. It will remain empirical until the complete physiology of the endocrine organs is understood. Workers such as Campbell and Collip are heading in this direction.

Abstracts from Current Medical Literature.

OPHTHALMOLOGY.

Sarcoma of the Iris.

W. ZEUTMAYER (*Archives of Ophthalmology*, February, 1931) reports the case of a boy of ten years with an ovoid flesh coloured tumour measuring three by five millimetres resting on the surface of the iris at the smaller circle. With the patient under ether anæsthesia as wide an incision as possible was made with a keratome and enlarged with scissors. The iris was seized close to the growth and both were withdrawn from the eye and excised. After healing occurred the patient was given five X ray treatments during the month, receiving a total dose of 175% of an erythema dose. The growth was a leucosarcoma. There has been no recurrence for three and a half years.

Ocular Symptoms in Xanthomatosis or Lipoid Histiocytosis.

PARKER HEATH (*Archives of Ophthalmology*, January, 1931) describes two cases of diffuse liporeticular disease, one of which ended fatally; in the other the patient recovered. They belong to the group showing bone defects, exophthalmos and *diabetes insipidus* (Christian's syndrome). The first patient was a boy of five years with exophthalmos, convergent squint and multiple cranial defects involving both tables of the skull and discharge from both ears. After death the defects in the skull were filled with a gummy, semicaseous, yellow tissue of rubbery consistency. The base of the skull was found irregularly covered with yellow granulomatous swellings which extended into both orbits. The second patient, a boy of four years, complained of a sore mouth. There was a cranial defect in the left parietal region, palpable posterior cervical glands and abdomen slightly distended. He had attacks of drowsiness and stupor. X ray examination revealed destruction of the floor of the sella and multiple cranial defects. He passed from 5·6 to 7·5 litres (six to eight quarts) of urine *per diem*. There was exophthalmos of the left eye and *otitis media* on both sides. Later Röntgen examination showed almost complete bony regeneration. The author explains the exophthalmos by the softening and bony loss at the apex of the orbit allowing the anterior pulling forces to draw the globe forward. In other cases yellow masses in the orbit push the eye forward. In the necropsy report the pathological changes diffusely involve the reticulo-endothelial system. The xanthoma nodules are made up of masses of proliferated reticular cells with many multinuclear giant cells. The second part of the paper suggests new classifications of ocular signs and syndromes that are apparently related. Ophthalmic clinical names are too much related to the location of the lesion rather than to the broad underlying pathological basis. Thus *arcus senilis* is a local storage reaction to the blood serum lipoids and can be produced in rabbits by a high cholesterol diet. The macular degeneration of Batten, Tay's disease, amauritic family idiocy, and many other conditions may be considered manifestations of liporeticular disease.

Glaucoma.

F. W. SWETT (*Archives of Ophthalmology*, April, 1931) found that incarceration of the iris in operations for glaucoma gave the best results, and on this finding has devised the following technique. A conjunctival flap is made and the cornea is divided with a keratome. An iridectomy is performed and the piece of iris is floated out in normal salt solution. A small section of the iris is picked up on a repositor, inserted into the anterior chamber and, by a sweeping motion, is placed in the sharp angle of the incision. The conjunctival flap is smoothed into place. The particle of iris does not become dislodged.

Syphilitic Iritis.

J. E. MOORE (*American Journal of Ophthalmology*, February, 1931) quotes Irons and Brown, who examined 200 patients with iritis and found 63 among them with syphilis. In 38 only of these was syphilis the certain ætiological factor, namely, in 19%. Bruns found 75% positive Wassermann reactions among 202 patients with iritis, mostly in negroes. The present study is based on 10,000 syphilitic patients, among whom were 249 cases of syphilitic iritis. In 111 of these the iritis was part of the original secondary outbreak; 29 developed as recurrence after inadequate treatment, and in 109 the iritis was a late manifestation. The figures show that syphilitic iritis is twice as common in negroes and that males are more liable than females. It is very liable to occur in a relapse. Syphilitic iritis cannot be differentiated from iritis due to some other cause, except in the case of *iritis papulosa*, and it is reasonable to suppose the iritis is syphilitic when it occurs in a proved syphilitic, unless other evidence is very strong. Complete physical examination is much more important than the history. The Wassermann test is most valuable in early iritis, giving positive results in 97%, and of least value in irido recurrence, in which only 55% of the results are positive. In late cases the test gives a positive result in 81%. A generalized skin rash was found in 75% of patients in the early stages. Syphilitic iritis is very often associated with other ocular lesions, especially in relapsing syphilis. Keratoiritis is the commonest complication and neuroretinitis and iridocyclitis are not infrequent. The author reflects upon the lack of investigation in the later cases of iritis and the tendency to consider syphilis as a diagnostic possibility last instead of first. Failure to recognize syphilis is a danger to the patient's sight. The ophthalmologist is warned against treating the patient without the advice of the syphilologist. The prognosis is best in patients with early secondary syphilis (good in 70%), worse in the recurrence group (good in 58%), and worse still in the late cases (good in 42%).

Inoculation of the Conjunctiva with Bacterium Granulosis.

F. I. PROCTOR, P. RICHARDS, M. GREENFIELD, W. C. FINOFF AND S. THYGESON (*American Journal of Ophthalmology*, April, 1931), working on the ætiology of trachoma, determined to try the effects of inoculation of the *Bacterium granulosis* on the human conjunctiva. Dr. P. Richards volunteered as the subject. He was not ideal for the purpose, as he was fifty-two years of age and had previously suffered from trachoma. The conjunctiva of the left eye was rubbed with mixed monkey tissue and *Bacterium granulosis* obtained from *Macacus rhesus* which was showing very advanced granular lesions. The right eye was inoculated subconjunctivally in the upper cul-de-sac with 0·5 cubic centimetre of a mixed suspension of five strains of *Bacterium granulosis* obtained from human beings. Three days later itching and photophobia were present in the left eye; the right eye was normal. Later on, acute catarrhal conjunctivitis appeared in the left eye. On the thirteenth day the right eye manifested mild papillary hypertrophy over the upper tarsus. An outside examiner reported that he would make a tentative clinical diagnosis of trachoma. Culture tubes inoculated with the secretions failed to yield *Bacterium granulosis*; but a monkey inoculated from the subject's left eye developed typical granules from which an organism similar to *Bacterium granulosis* was isolated. A second volunteer appeared in Myrtle Greenfield, aged forty-four, who had never suffered from trachoma. A saline suspension of five strains of *Bacterium granulosis* was instilled into the left eye and the instillation was repeated every three hours until six had been given. A few days later these were repeated and bacteria taken directly from the tubes were applied directly to the left eye on five occasions. On the fifth day secretion and palpable congestion appeared, and on the eighth day general tarsal hyperæmia, swelling of the lids and slight ptosis. During the next four days granulations became slightly more pronounced, follicles were present in rows and the eyes had the clinical appearance of early trachoma. The authors conclude that the *Bacterium granulosis* is pathogenic to the human conjunctiva and

that it produces a granular disease which is clinically indistinguishable from early trachoma.

OTO-RHINO-LARYNGOLOGY.

The Control of Hæmorrhage After Nose and Throat Operations.

T. CARROLL DAVIS (*The Laryngoscope*, February, 1931) describes a method of controlling hæmorrhage after nose and throat operations. Disks consisting of very thin layers of an aseptic gelatin-glycerin base impregnated with antipyrin-tannin are cut and shaped to make them adaptable to their respective uses. A special holder is also described for holding the melting disk in contact with the raw bleeding surface. Only about 0·016 to 0·02 gramme (one-fourth to one-third of a grain) of the antipyrin-tannic acid is used in each disk, a perfectly harmless quantity.

Symptomless Acute Mastoiditis.

N. ASHERSON (*The Lancet*, February 14, 1931) records the histories of four patients who suffered from symptomless acute mastoiditis. The only physical sign detected in each of the first two patients was a sagging of the posterior wall of the osseous meatus which obscured a view of the tympanic membrane. Operation in each instance revealed pus in the mastoid process and the presence of a perisinus abscess. The second of the patients, a child of five years, was discharged from hospital with the mastoid wound healed, but three months afterwards was readmitted with a temporo-sphenoidal abscess which proved fatal. In the third patient the drum could not be seen on account of the sagging of the posterior superior osseous meatal wall. Pus could be seen deep to the tumefaction, and as fast as it was mopped out it tended to reaccumulate. The fourth patient had had chronic otorrhœa for three months with profuse discharge, and was admitted for observation on account of morning vomiting of recent onset. While the patient was under observation the discharge continued to be profuse; no other symptoms or signs developed. Operation revealed a small antrum containing a little pus, and on removal of the roof of the antrum a large extradural abscess was revealed. It is suggested that sagging of the meatal wall may be the only sign or symptom of a suppurative condition in the mastoid process and that its presence indicates that it is imperative to open the mastoid forthwith; also the rapid accumulation of pus in the meatus is a significant sign for operation.

External Ethmo-Frontal Operations.

W. LIKELY SIMPSON AND SAM H. SANDERS (*The Laryngoscope*, January, 1931) present a number of observations made on a series of over 100 patients with ethmoid and frontal sinusitis who were operated upon by the external route. They give their conclusions as follows. Morphine and scopolamine analgesia combined with local anæsthesia has its advantages over general anæsthesia. A short skin incision gives sufficient exposure for the operation on an average sized frontal sinus. Practically all bleeding can be controlled without the use of ligatures. Removal of the entire lining mucosa of the sinus is required to obtain desired results. A view of the entire sinus cavity is usually necessary to remove the entire lining mucosa, and this can be easily obtained by the use of mirrors. Good results have been obtained when the outer bony angle of the frontal floor has not been removed. Retention of the ethmo-orbital wall prevents a displacement of the orbital contents. The external route offers a safer approach and affords a better view of the ethmoid, especially the supraorbital and those cells around the naso-frontal duct. The middle turbinate is a valuable landmark and does not interfere with operative procedure or good results. Subcutaneous sutures are unnecessary. Poor cosmetic results are no longer considered contraindications for external frontal operations.

Antrotomy in Children During Tonsillectomy.

SIMON STEIN (*The Laryngoscope*, February, 1931) refers to the common occurrence of sinusitis in children. He has assembled a group of 443 patients who suffered from antral infections and were brought up for tonsillectomy, ranging in age from one and a half to ten years. These patients had a sinusitis in addition to the diseased tonsils and adenoids, and the sinuses were drained at the time of the tonsillectomy and adenoidectomy. On reexamination of the children at the end of a week it was found that in 250 the discharge had entirely disappeared. The discharge had materially decreased in 103 of the patients. The discharge had changed in character from a thick mucous or purulent one to a more fluid type in 90 of the patients. The author describes the technique of the operation and the post-operative treatment, and is of the opinion that in the average case, when there are no acute symptoms, it is a perfectly safe procedure to drain the antra at one and the same time as the removal of the tonsils and adenoids.

The Eustachian Tube.

A. R. TWEEDIE (*The Journal of Laryngology and Otology*, March, 1931) in an address on the Eustachian tube refers to the article written by Eustachius from which the Eustachian tube derives its name, and briefly discusses the present ideas of the importance of the tube. He reminds us of the fact that during the last four hundred years we have made very little progress with regard to the physiology and pathology of the Eustachian tube. The author, however, draws attention to recent studies made by British workers with regard to the flow of mucus and its chemical reaction, and concludes with a strong recommendation for further research on these lines.

Cancer of the Larynx.

ST. CLAIR THOMSON (*The Journal of Laryngology and Otology*, January, 1931) in a discussion on the diagnosis of cancer of the larynx gives the following conclusions. An early diagnosis of extrinsic cancer is not likely to be established until the public learns to consult medical practitioners earlier for slight but persistent pharyngeal symptoms, and until medical practitioners are more constantly on the *qui vive* for cancer in men of cancer age and in women of any age. In intrinsic cancer there should be no hurry in the attempt to establish a diagnosis. A few weeks of vocal rest (even silence), abstinence from tobacco, reduction of alcohol, and repeated examinations are valuable aids in confirming or eliminating a suspicion, while the delay gives the opportunity for other complete investigations. These investigations, besides a blood examination, should include every reliable test for tuberculosis. Tuberculosis is more often mistaken for cancer than any other condition. The mistake of diagnosing an epithelioma in the larynx as tuberculous is less frequent. All neoplasms removed from the larynx should be carefully examined under the microscope, and the larynx should be inspected once a fortnight for the three succeeding months. In the case of a malignant growth (whether indicated or not by the microscope), however completely removed, a recurrence will develop within that time. If the biopsy reports show the growth to be innocent, such a recurrence will almost certainly prove it to be malignant. True subglottic cancers are very difficult to diagnose in an early stage, as the symptoms are absent or insignificant until the neoplasm has extended far enough to invade the edge of the cord. It is in such circumstances and in all doubtful cases that an exploratory laryngofissure may be justifiable. When the diagnosis remains doubtful in spite of complete investigation, repeated observation and rest to the larynx, a biopsy is indicated. This, however, does not always give a positive finding. It is most useful when appearances suggest an innocent neoplasm or a tuberculous lesion. When a satisfactory portion of the growth can be secured for a biopsy, this should be carried out, as it will not only be a diagnostic point, but will also be a help in deciding on treatment, as a section will indicate the grade of malignancy. In the words of Chevalier Jackson: "Every adult patient with hoarseness should be considered as possibly cancerous until proved otherwise." If the diagnosis remains doubtful it may be well to advise a middle-aged or elderly subject to submit to treatment by the laryngofissure route sooner than risk the strain of uncertainty and the danger of delay.

Special Articles on Diagnosis.

(Contributed by Request.)

LVIII.

THE DYSENTERIES.

DYSENTERY is an inflammatory condition of the mucous membrane of the large bowel, which frequently progresses to necrosis (ulceration). Its main clinical features are: diarrhœa, abdominal pain, tenesmus, and the presence of blood and slime in the fæces. Dysentery may be caused by bacteria, protozoa or worms. Several types of bacilli have been incriminated: *Bacillus dysenteriæ* (Flexner) and *Bacillus dysenteriæ* (Shiga) are the most important, but *Bacillus pyocyaneus* and Sonne's bacillus may both be associated with dysenteric disorders. Among the protozoa mentioned as able to cause dysentery are: *Entamœba histolytica*, *Balantidium coli*, *Giardia intestinalis*, *Leishmania donovani*, and *Plasmodium falciparum*. The worms causing symptoms of dysentery are the three human schistosomes (*hæmatobium*, *mansoni* and *japonicum*) and *Œsophagostomum apiostomum*. Doubtless there are other organisms that are capable of causing inflammation and ulceration of the large bowel.

Amœbic and bacillary dysenteries only are discussed here, but, as the rarer forms may have to be considered in a differential diagnosis, they are worthy of a few words. No description is given of the distinguishing features of the organisms concerned, but here and there a hint is given concerning the sort of thing to be looked for. The aid of the text book should be sought for detailed descriptions.

Giardia intestinalis is one of the commonest of human protozoa. Its normal habitat is the small intestine; it is of doubtful pathogenic importance, and its presence in a stool containing pus and blood is not sufficient evidence that it is the causal organism. It is present in normal stools only in its encysted form, but when there is diarrhœa it may occur as a freely moving flagellated protozoön that is readily recognizable under the one-sixth inch or the oil immersion objective.

Balantidium coli is a large oval ciliated organism, 30 μ to 200 μ in length by 40 μ to 60 μ in breadth. It is an uncommon cause of dysentery. It cannot be missed in a microscopical examination.

Leishmania donovani is the causal organism of kala-azar. It sometimes causes ulceration of the intestinal mucosa in the later stages of the disease. The person affected with kala-azar has lately come from an endemic area, he suffers from irregular fever, he is emaciated, his spleen and liver are greatly enlarged, the leucocytes of his blood are remarkably decreased in numbers, and *Leishmania donovani* can be found in his blood or spleen pulp.

Plasmodium falciparum is sometimes associated with dysenteric symptoms that clear up when quinine is administered in a suitable dosage. There are usually other evidences of malaria, such as rigors and sweats and enlargement of the spleen. The plasmodia can be found in the blood, usually in large numbers.

Schistosomiasis can as a rule be readily diagnosed by microscopical examination of the fæces; the ova of the schistosomes have pronounced distinguishing features which render them easy to recognize. The eosinophile cells of the blood are greatly increased in numbers. Inquiry should be made whether the patient has resided in an endemic area.

Œsophagostomum apiostomum occurs in West Africa. It is capable of causing dysenteric symptoms. The worms and eggs are passed in the stools. The worms are 17 to 30 millimetres in length and have distinguishing characteristics that are easily observed by means of the low power objective of the microscope.

Conditions that may be mistaken for dysentery are: hæmorrhoids, anal fissure and anal fistula, carcinoma of the rectum, rectal polypi, syphilis of the rectum, tuberculous ulceration of the large bowel, ulceration due to chronic constipation, ulcerative colitis, and muco-membranous colitis. The recognition of most of these depends merely on ordinarily careful clinical examination. It may be difficult, however, to differentiate ulcerative colitis from amœbic dysentery. If careful microscopical examination of the stools on seven successive days reveals no amœbæ, it is safe to assume that the condition is not amœbic dysentery. The diagnosis may be confirmed by sigmoidoscopic examination of the ulcers.

The general bodily disorders that may be associated with the passage of blood in the stools should not give rise to any difficulty in the diagnosis.

Acute Bacillary Dysentery.

The commencement of bacillary dysentery is frequently preceded by a period of constipation. The onset is usually sudden and associated with toxæmia of greater or less severity: the temperature is usually moderately raised, sometimes it is very high, sometimes it is normal; the pulse is rapid and the skin dry. Infants and young children especially are apt to be overcome by severe toxæmia; convulsions may occur. Infants, at the outset, become drowsy and disinclined for food; their skin is hot and very dry; their faces are pale, perhaps ashen.

Griping pain below the umbilicus is an early symptom, but diarrhœa does not usually commence until some hours have elapsed. On the other hand, the onset may be insidious. Perhaps for a few days the patient suffers from diarrhœa; abdominal pains commence, and blood and slime appear in the stools. In such instances the toxæmia is not usually severe, nor is the attack of long duration.

At first the stools are thin, fæculent and foul. Soon blood and pus appear, tenesmus commences, the calls to stool become frequent and insistent, and, as Manson remarks, the patient becomes "glued to the commode." The quantity he passes at each evacuation may be no more than a teaspoonful, but he receives no respite. The stools lose their fæcal character and consist merely of blood-stained mucus, which has been likened to red-currant jelly. In text books it is generally stated that these stools are odourless. Sometimes they are, but very often they are not. The odour of the stools during the first few days seems to depend on whether the patient is taking food and, if so, what type of food. Milk has a definite influence. If a baby suffering from dysentery is given a milk diet, its stools are usually very foul.

At the end of about a week, if ulceration occurs, stinking grey shreds of sloughing mucosa may appear in the stools.

Except in cases of great severity, the fever subsides somewhat within twenty-four hours of the onset. It may then remain normal for the duration of the illness, or about 37·2° C. (99·0° F.) or 37·8° C. (100·0° F.) for a week or thereabouts. The toxæmia too is not nearly so pronounced after the first day or so.

Emaciation rapidly ensues, and dehydration becomes pronounced.

Physical examination of the abdomen reveals tenderness, especially over the sigmoid portion of the colon. In the early stages the abdominal muscles are strongly contracted; later they relax sufficiently to allow palpation of the firm rope-like sigmoid colon.

The duration of the attack is variable. It may be less than a week or longer than a fortnight. The severity of the disease varies from the mild attack, during which the patient hardly feels it necessary to take to his bed, to the violent fulminating attack, which may cause death before a dysenteric stool is passed. A frequently fatal choleraic form has also been described.

Chronic Bacillary Dysentery.

In some instances bacillary dysentery becomes chronic. For weeks or months the stools continue to be thin and to contain mucus and, frequently, blood. Abdominal discomfort persists. Fatigue, exposure to chill, alcoholic

excess, or dietary indiscretion, may cause a recurrence of the earlier severe symptoms. The sufferer is emaciated, pale and feeble.

Amœbic Dysentery.

Amœbic dysentery is sometimes known as "tropical dysentery," but it is not confined to the tropics, nor is it nearly so common in the tropics as bacillary dysentery.

It is a rarity for intestinal amœbiasis to be eradicated after one paroxysm of dysentery. The infection remains and is liable to cause relapses at longer or shorter intervals.

The onset of amœbic dysentery is insidious. There is no toxæmia comparable to that caused by bacillary dysentery, and the temperature is not raised above normal unless there is a complication, such as abscess of the liver. The patient is not called to stool so frequently nor so urgently as is the sufferer from bacillary dysentery, nor are his pains so severe. Tenesmus is often absent. The stools are often fairly large, and may be no more numerous than three or four in the twenty-four hours. As a rule they contain considerable quantities of blood. When the disease is well advanced they often present an appearance which has been described as resembling that of anchovy sauce. Sometimes they consist mainly of dark-coloured blood in which there are flecks or small pieces of greyish slough. Sometimes they are formed stools, streaked with blood and mucus. They are always fœtid.

Usually, patients subject to recurring attacks of amœbic dysentery lose a lot of weight; sometimes they become very emaciated; but sometimes they remain in surprisingly good condition despite their illness.

Amœbiasis produces such variable effects that it is a wise precaution to examine the stools of any person subject to intestinal disturbances, whatever their nature, especially if he is an ex-resident of the tropics.

Sometimes the attention is drawn to the existence of intestinal amœbiasis only when symptoms of amœbic hepatitis arise.

Sprue may sometimes be confused with amœbic dysentery, and it is important to remember that sprue may be a sequela of amœbic dysentery. The bright red sore tongue of the sprue patient, the muddy complexion, the swollen belly, the diminished liver dulness, and the huge pale fermenting stools, should suffice to differentiate the two. But the stools should always be examined for *Entamœba histolytica*.

The Examination of the Stools.

A fresh specimen of the whole stool should be obtained if possible, and a portion picked out for examination. This task should not be left to the nurse, who, unless she has had experience, usually selects a piece that is most fæcal and least suitable. Pieces containing mucus should be selected, and a loopful picked up and placed on a slide for microscopical examination. If the stool is fluid, there is no need to add saline solution or other diluent; a cover glass may be placed on the slide and examination made by means of the one-sixth inch or oil immersion objective. If the patient is suffering from dysentery, the stool contains pus cells and usually red blood cells. The stools of a patient suffering from bacillary dysentery contain comparatively few bacteria, those of a sufferer from amœbic dysentery teem with bacteria: the difference is striking. The macrophage cells of bacillary dysentery have frequently been mistaken for resting amœbæ; they are roughly the same size as *Entamœba histolytica* and sometimes contain ingested erythrocytes, but they are non-motile.

In a fresh amœbic dysentery stool *Entamœba histolytica* can be seen moving, but it becomes motionless shortly after the stool is passed, especially in cold weather. The movements are typically amœboid; the progress is comparatively rapid; the pseudopodia are protruded suddenly and contain only hyaline protoplasm. *Entamœba histolytica* is most likely to be confused with *Entamœba coli*, a common and probably harmless inhabitant of the human intestine. The more important distinguishing features of the two are set out in the following comparative statement:

Entamœba histolytica.	*Entamœba coli.*
Size: 20 μ to 30 μ.	Size: 18 μ to 40 μ.
Clear ectoplasm, granular endoplasm.	No distinction between endoplasm and ectoplasm.
Ingests red blood cells and other cells.	Ingests bacteria, other protozoa and tissue *débris*.
Nucleus is indistinct.	Nucleus is distinct in fresh specimens.
Rapid explosive movements. Pseudopodia are clear.	Movements are slow. Pseudopodia contain granular protoplasm.

In the intervals between relapses, *Entamœba histolytica* occurs only in the stools in its encysted form. It is not proposed to discuss here the appearances of the cysts of the various intestinal amœbæ.

A search should be made for Charcot-Leyden crystals. These are variable in size (5 μ to 25 μ); they are rather sharply pointed at either extremity, and have the general shape of a whetstone. Their presence is said to be pathognomonic of amœbic dysentery.

The examination of the stools is a procedure requiring a great deal of experience. There are many traps and pitfalls. The medical practitioner who is unable to obtain such experience is well advised to regard as *Entamœba histolytica* only those organisms that are rapidly moving, that contain red blood cells, and protrude pseudopodia containing hyaline ectoplasm.

Differential Diagnosis Between Amœbic and Bacillary Dysenteries.

Provided with the above rather meagre information, the medical practitioner should be able to make a diagnosis of dysentery. His next problem is to diagnose the type of dysentery. The points of differential diagnosis can be set out best, perhaps, in parallel columns.

Bacillary Dysentery.	Amœbic Dysentery.
An acute disease that often occurs in epidemics; it has a duration of a week or several weeks; and sometimes becomes chronic.	A chronic disease characterized by a succession of relapses or exacerbations.
Onset usually sudden and associated with pronounced toxæmia.	Onset insidious; toxæmia slow in developing.
Fever usual.	Fever unusual.
Severe abdominal pains and tenesmus; abdominal tenderness, especially over sigmoid colon.	Pains not so severe. Tenesmus frequently absent. Tenderness not so pronounced and more definitely localized.
Stools small and numerous; may resemble red-currant jelly; often odourless.	Stools larger and not so numerous; contain fæcal material, blood and mucus; may resemble anchovy sauce; always foul smelling.
Neutrophile cells are numerous and well defined; macrophage cells are common; bacteria scanty.	Neutrophile cells present, but their nutrition is interfered with and their nuclei are often extruded; many motile bacteria are present; Charcot-Leyden crystals are often present; *Entamœba histolytica* is present.

Sometimes sigmoidoscopic examination is of value in diagnosis, but it has a more important place in prognosis

and in the estimation of progress. It is not discussed here, but it may be mentioned that the passage of the instrument causes great pain to the person suffering from bacillary dysentery and but little to the person affected with amœbiasis.

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British Medical Association News.

SCIENTIFIC.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Melbourne Hospital on May 20, 1931. The meeting took the form of a series of clinical demonstrations.

Nephritis.

DR. W. W. S. JOHNSTON showed three patients illustrating various aspects of nephritis.

The first patient suffered from acute nephritis with convulsive uræmia and at the time of the meeting had apparently recovered.

The patient, a boy, aged sixteen years, was admitted to hospital on December 2, 1928, with acute uræmia. Three weeks before admission he had a sore throat accompanied by fever, and four days before admission the face and legs appeared slightly swollen.

On examination soon after admission the face was slightly puffy, the legs, however, showing no œdema. Internal strabismus and mental confusion were present. The heart was normal, the systolic blood pressure was 220 and the diastolic pressure 100 millimetres of mercury. Albumin was present in the urine in large amount, together with a few granular and hyaline casts, many red blood cells, but no leucocytes. The blood urea was 37 milligrammes per 100 cubic centimetres of blood. During the first eighteen hours after admission there were numerous convulsions. Venesection was carried out, with a reduction in blood pressure to 150 millimetres of mercury systolic and 110 millimetres diastolic. Concentrated magnesium sulphate solution was given by stomach and rectal tubes. At this stage 40 cubic centimetres of smoky urine were drawn off by catheter.

By December 6, 1928, the patient felt quite well, the systolic blood pressure then being 170 and the diastolic 120 millimetres of mercury. The urine contained rather less albumin, with an output of 600 to 900 cubic centimetres (twenty to thirty ounces) every day.

The fundi were pronounced normal and the Wassermann test gave no reaction.

By December 13, 1928, the systolic blood pressure had fallen to 122 and the diastolic pressure to 85 millimetres of mercury; the albumin was further lessened, though there were still many red blood cells and some hyalo-granular casts. The output had increased to 1,200 or 1,500 cubic centimetres (forty or fifty ounces) a day. By December 25, 1928, the albumin had still further decreased and red blood cells and casts could no longer be found. On February 10, 1929, there appeared traces of blood in the urine, lasting for a few days, but apart from this the progress was continuous. By September 23, 1929, the albuminuria had ceased and had not since reappeared.

Dr. Johnston said that the chief points of interest in the case were the favourable response to venesection and the apparently satisfactory recovery of the kidneys after the particularly severe symptoms during the early stages of the illness.

Dr. Johnston's second patient, a man, aged fifty-seven years, suffered from chronic nephritis (with œdema). The patient was admitted to hospital on January 23, 1931, with generalized œdema. Four weeks previously he had been wet through at work and subsequently developed a "chill" and slight sore throat. Two weeks later œdema, dyspnœa and diminished output of urine were noticed. On January 23, 1931 (the day of admission), examination revealed generalized œdema, a normal heart, a systolic blood pressure of 116 millimetres and a diastolic pressure of 68 millimetres of mercury, and normal fundi. The urine contained much albumin, many casts (including some granular), a few leucocytes, but no red cells.

The treatment instituted comprised a salt-free diet and limitation of fluids, the administration of "Theocin" followed by "Diuretin." As the urinary output did not improve, urea was then given. The urinary output went up almost immediately and later the dose of urea was halved and a high protein diet given.

By March 3, 1931, the œdema had disappeared. The albuminuria of gross degree persisted, while many casts were still present. By May 11, 1931, the urine was free from albumin and from abnormal cellular elements. The blood urea soon after admission was 40 milligrammes per 100 cubic centimetres of blood, and shortly before discharge 36 milligrammes.

Dr. Johnston gave details of the other investigations that had been carried out and said that the interesting features of the case were: (i) the response to the administration of urea; (ii) the apparent return to normal of the kidneys, as shown by examination of the urine and satisfactory renal function; and (iii) the relationship of this case to those of the much debated condition of "nephrosis."

Dr. Johnston's third patient was a girl, aged fifteen, who had been shown two years previously as a sufferer from chronic nephritis with œdema. She had been admitted to hospital in June, 1928, suffering from acute nephritis complicated by perinephric abscess. The latter condition responded to surgical treatment. There was a history of lessening amount of urine for the three months prior to admission and swelling of legs for two months.

On examination shortly after admission œdema of face and legs was present. The heart was normal. The systolic blood pressure was 125 and the diastolic pressure 90 millimetres of mercury. The urine contained a large amount of albumin, a few red cells and leucocytes, and many casts, both granular and hyaline. The blood urea concentration was 61 milligrammes per hundred cubic centimetres. The urea concentration test gave a maximum figure of 1·4%.

During the following two and a half months there was gradual improvement, except for an interval during which the blood pressure had risen fairly rapidly and then subsided again.

In September, 1928, the patient was discharged from the ward to the out-patient department. At this time there was still slight œdema of the face and ankles. The urine manifested gross albuminuria, an occasional red cell, a few leucocytes, many granular and hyaline casts. The urinary excretion increased. By this time renal function was considerably improved. Large doses of thyreoid extract were given and a high protein and salt-limited diet instituted concurrently. There was gradual approximation to normal findings. This was the condition when the patient was shown two years previously.

Dr. Johnston said that since that time the urinary examination had revealed no albumin and no abnormal deposit. The renal function tests had been satisfactory, as shown by a blood urea reading of 34 milligrammes per hundred cubic centimetres of blood and a urea concentration test with a maximum of 3·0%. A recent blood pressure reading was 128 millimetres of mercury systolic and 76 millimetres diastolic.

Dr. Johnston pointed out that the history of this patient showed some points of similarity with that of the second patient, for example, the gradual subsidence of the œdema and the apparent satisfactory return to normal health. There were, however, important differences, notably at one stage the impairment of renal function in regard to nitrogenous excretion and the rise in blood pressure, which

indicated a well marked condition of glomerulo-nephritis and thus excluded it from the class of "nephrosis."

Tumour of the Cauda Equina.

DR. L. E. HURLEY showed a female, aged thirty-five years, who had been admitted to hospital on November 6, 1930. The past history was normal, except for mumps and measles as a child.

Thirteen months before admission the patient complained of severe pain in the calf of the right leg, which persisted for about six months. During this time there were no other symptoms.

Four months before admission she noticed severe aching pain in the back of the right thigh, radiating up to the sacrum and down the external aspect of the right calf and into the toes. On the following day she had retention of urine and lost all bowel and bladder sensation. The right leg also became very weak. One week later incontinence of both urine and fæces developed. At this time she was admitted to another hospital, whence she was discharged after a period of seven weeks, feeling much better, but with some weakness in the right leg.

The day before her admission to the Melbourne Hospital the severe pain in the right lower limb returned, the bowels were constipated and there was some incontinence of urine. She also vomited several times and had shivers and sweats.

On physical examination, apart from a marked pyuria and bacilluria, nothing abnormal was detected, except in the nervous system. There was marked diminution of sensation to pin prick and cotton wool touch over the whole skin area supplied by the sacral segments, especially over the second sacral segment. All the superficial and deep reflexes were present, except the ankle jerk and the anal reflex. The plantar reflexes were flexor in type. There was marked wasting of the muscles in the right gluteal region and in the calf of the right leg. There was some weakness of all movements in the right lower limb, but more particularly of extension, abduction and external rotation at the hip, flexion of the knee, and of all movements of the ankle and foot. Lumbar puncture was performed, but no fluid could be obtained. The Casoni test for hydatid disease gave no reaction. Cerebro-spinal fluid obtained by cistern puncture showed no increase in cells or globuln; the Wassermann and colloidal gold tests gave no reaction. X ray examination done after the injection of lipiodol by the cistern route showed that the lipiodol had blocked at the level of the fourth lumbar vertebra and a further X ray examination made several days later showed it to be still in the same position. There was also sacralization of the fifth lumbar vertebra on the right side.

On November 20, 1930, laminectomy was performed by Mr. Zwar and a tumour the size of a small cherry removed. The tumour was pedunculated and arose from the intervertebral disc between the fifth lumbar and first sacral vertebra. On section the tumour presented the appearance of white fibrocartilage. At the time of operation two radium needles were inserted at the site of the tumour and removed seven days later. Since operation the patient had steadily improved, muscular power had almost completely returned, there had been no return of the pain, but she still had some loss of sensation over the sacral segments and slight lack of control over the bladder, but no real incontinence.

Malignant Disease of the Lung.

Dr. Hurley's next patient was a male, aged thirty-nine years. Ten months ago he had what was regarded as an attack of bronchitis, lasting three weeks. A week later he developed signs of a left-sided pleural effusion which was tapped four times in the following month. Two needlings of the chest in the next fortnight revealed no fluid. The patient stated that as far as he knew the fluid was straw coloured. Ever since this time he had a cough and brought up considerable amounts of sputum which at times were blood-stained. In the twelve months before admission he lost 12·6 kilograms (two stone) in weight.

After his admission to hospital the patient had an evening temperature which had varied between 37·2° and 38·3° C. (99° and 101° F.). There was definite diminution of movement in the left side of the chest. The trachea was displaced to the left, and the whole of the left lung was dull to percussion. The breath sounds were very much diminished over the whole of the left lung, except immediately below the clavicle, where there were amphoric breathing and whispered pectoriloquy. The sputum was examined many times and no tubercle bacilli were detected. X ray examination revealed uniform dulness throughout the whole of the left side of the chest. X ray examination after the injection of lipiodol showed that some of it had entered the right lung, but none the left. Bronchoscopic examination showed that the left main bronchus was reduced to about three-quarters of its normal size, and about the entrance to both bronchi were a number of small polypoid masses, one of which was removed and on microscopical examination proved to be carcinomatous.

Dr. Hurley commented on the difficulties attending diagnosis of malignant disease of the lung. He said that in the patient presented the ordinary physical examination and the history, especially the disappearance of the fluid after several tappings, at first suggested a diagnosis of pulmonary tuberculosis.

Chronic Nephritis.

Dr. Hurley also showed macroscopical and microscopical specimens of the kidneys of a male, aged twenty-eight years, who had been admitted to the Melbourne Hospital in 1921 complaining of "hæmaturia." At this time he complained of headache and slight weakness in the legs for three days, but was chiefly concerned because of the blood in his urine. The urine contained much blood and albumin and a few leucocytes, and on his discharge from hospital about a fortnight later blood and albumin were still present. X ray examination of the urinary tract revealed nothing abnormal. The systolic blood pressure was 140 and the diastolic 80 millimetres of mercury.

For the next seven years the patient remained well and no examinations of his urine were made. Three years ago he began to complain of lassitude and headache, and found that he had to get up at night three or four times to pass urine. In the past five months he frequently woke up in the morning with a severe headache which would ease off later in the day. A few weeks before admission to hospital he noticed that he was passing less urine, became short of breath, and occasionally had a little puffiness under the eyes. A few days before his admission to hospital on March 25, 1931, he had an attack of acute pulmonary œdema and vomited several times. He worked right up to the day before the attack of pulmonary œdema.

On examination he looked very pale. The blood contained 2,450,000 red corpuscles per cubic millimetre and the hæmoglobin percentage was 51. The cardiac apex was in the sixth intercostal space 12·5 centimetres (five inches) from the mid-line. There was a loud systolic murmur audible over the whole precordial region, but loudest at the apex. The systolic blood pressure was 205 and the diastolic 140 millimetres of mercury. The urine contained much albumin and many red blood corpuscles, granular casts and leucocytes. The *fundi oculorum* showed early changes of albuminuric retinitis. The blood urea on March 26, 1931, was 45 milligrammes *per centum*. After his admission to hospital the vomiting continued intermittently and the patient's general condition showed no improvement. On April 17, 1931, the blood urea was 353 milligrammes *per centum*. Severe precordial pain accompanied by a pericardial friction rub then appeared. On April 27, 1931, the blood urea was 626 milligrammes *per centum*, and on the following day death occurred.

At autopsy the kidneys were smaller than normal and showed an evenly granular surface. The capsule was thickened and slightly adherent. The kidney substance was much indurated and contained several small cysts. The cortex was very narrow. Microscopically there was an enormous increase in the interstitial tissue, and the walls of the vessels were grossly thickened. The glomeruli were closely packed together, their capsules were thickened, and their substance showed lobulation, hyaline changes in the capillaries and increase in connective tissue. There was dilatation of many of the kidney tubules, the

epithelium of which, in many regions, showed evidence of degeneration.

The prognosis of acute nephritis was briefly discussed by Dr. Hurley. He pointed out that some cases of acute hæmorrhagic nephritis were easily overlooked or regarded as cases of hæmaturia of obscure causation, especially if they passed into a subacute stage. The majority of patients with acute hæmorrhagic nephritis made a good recovery, but a few passed on to a subacute and later a chronic stage. Dr. Hurley emphasized the importance of removing septic foci and of keeping the patient at rest during the acute attack until the urine was clear.

Congenital Aneurysm.

Dr. Hurley's next patient was a male, aged twenty-two years, who had been admitted to the Melbourne Hospital on May 7, 1931. He was quite well until threre days before admission, when he noticed quite suddenly a severe frontal headache and pains in the eyes. During the next three days he was drowsy and vomited several times. He also complained of some dimness of vision.

On admission he was very lethargic and it was difficult to obtain a clear history from him. The temperature was 37·8° C. (100° F.), the pulse 48 and the respirations 22 in the minute. He resented any interference and lay curled up in bed with his eyes closed and his head beneath the bed clothes. There was definite neck stiffness and a positive Kernig and spine sign. Lumbar puncture yielded cerebro-spinal fluid evenly blood stained in all three tubes. There were 1,700 red cells and 18 leucocytes per cubic millimetre. The globulin was slightly increased and on centrifuging the supernatant fluid was a bright yellow colour. The sugar content was 0·065 *per centum* and the chlorides 726 milligrammes per hundred cubic centimetres. The Wassermann test gave no reaction.

On May 9, 1931, he was much more intelligent, and the headache was not so severe. He steadily improved, and at the time of presentation felt quite well and showed no neurological signs. Dr. Hurley discussed cerebral aneurysms, syphilitic, arteriosclerotic and congenital. He said that a similar patient to the one presented had been admitted to the hospital a few weeks previously. After a temporary improvement the patient had suddenly become comatose and died. At autopsy a congenital aneurysm, which had at first leaked into the cerebral substance and then suddenly ruptured, had been disclosed.

Obscure Cerebral Lesion.

Dr. Hurley also presented X ray films taken from a female, aged twenty-eight years. About ten months ago she noticed weakness and stiffness in the right leg, followed several months later by similar symptoms in the opposite leg. During the same period she had aching pains in various parts of the body, but nothing in the nature of root pains. In the last few weeks she noticed some unsteadiness in her gait.

On examination there was spastic weakness in both lower limbs. The plantar reflexes were extensor in type, and the superficial abdominal reflexes absent. The deep reflexes were exaggerated, the right knee jerk being more active than the left. Vibration sense was absent up to the level of the sixth thoracic vertebra. Posterior column sensation was very defective in both lower limbs. There was slight diminution to pin prick, the upper level of which varied considerably from just below the nipples to as low as the umbilicus. The visual fields were normal, but there was abnormal pallor of the optic discs, particularly on the temporal side. The cerebro-spinal fluid showed no increase in cells or globulin and did not react to the Wassermann test. There was slight scoliosis in the upper dorsal region. X ray examination, conducted twenty-four hours after the injection of lipiodol by the *cisterna magna* route, showed that it had all been held up at the level of the third thoracic vertebra. Several days later the lipiodol was at the level of the eighth thoracic vertebra, and a few days later still it had descended to the bottom of the spinal theca. Queckenstedt's test gave evidence of a partial spinal block. When pressure was exerted on the jugular veins the cerebro-spinal fluid pressure rose slowly from 120 to 250 millimetres and on release of the vein pressure fell slowly over a period of several minutes to 140 millimetres. Laminectomy was performed, but nothing beyond a few adhesions at the level of the third thoracic vertebra was discovered. Dr. Hurley said that the diagnosis as between a small intramedullary tumour and a spinal type of disseminated sclerosis was still in doubt. He outlined briefly the theory and value of Queckenstedt's test.

Auricular Fibrillation.

Dr. Hurley also showed electrocardiographic tracings taken from a female patient who for twenty years had had typical attacks of paroxysmal tachycardia, during one of which a tracing had been obtained. A little over three years ago the patient developed one of her usual attacks, but it persisted for three months and resisted all efforts at restoration of normal rhythm. Large doses of digitalis brought about auricular fibrillation, which at the time of presentation had been in existence for just over three years.

Disseminated Sclerosis.

DR. IVAN MAXWELL showed a woman, aged twenty-eight years. The patient's symptoms dated from the termination of her pregnancy some three months previously, when she became temporarily blind in the left eye and almost blind in the right eye. Prior to parturition marked albuminuria and a raised blood pressure were detected by her medical attendant. Following the puerperium the patient noticed weakness in her right leg and a tendency to drag the foot. This weakness gradually became more pronounced and extended to the left leg. On admission to the Melbourne Hospital examination of her nervous system revealed nystagmus, absent superficial abdominal reflexes, exaggerated biceps, triceps, knee and ankle jerks, double patellar and ankle clonus, and double extensor plantar reflexes. There was marked pallor of the optic discs, but vision was moderately good. The chloride content of the cerebro-spinal fluid was 753 milligrammes per hundred cubic centimetres, the sugar 0·08 *per centum* and the cell content normal. Maclean's urea concentration test indicated 2·25%, 2%, and 2·5% urea respectively in the first three hours. The blood urea was 47 milligrammes per hundred cubic centimetres. The Wassermann test applied to the blood and cerebro-spinal fluid gave no reaction. The blood pressure was 192 millimetres systolic and 150 millimetres diastolic. No alteration in speech was detected. Micturition was accomplished with difficulty and at times retention occurred. The patient's condition was diagnosed as one of disseminated sclerosis.

DR. JOHN F. WILLIAMS agreed with the diagnosis and stated that the administration of an anæsthetic frequently aggravated this disease. This patient, however, had no anæsthetic during parturition.

Hepatomegaly and Multiple Thromboses.

The second patient, a male, aged forty-six years, exhibited hepatomegaly and multiple thromboses. Two months prior to admission to hospital this man noticed a swelling of his left leg below the knee. At the same time general weakness developed and was accompanied by diarrhœa and increasing pallor.

When examined at the Melbourne Hospital the patient was found to have an enlarged liver, the organ reaching to the umbilicus. It had a firm irregular surface and moved with respiration. There was no evidence of cardiac failure. A barium meal and barium enema revealed nothing abnormal in the gastro-intestinal tract. A test meal revealed hypochlorhydria. Blood examination gave the following figures, which Dr. Maxwell took to indicate a secondary anæmia. Hæmoglobin value, 25%; erythrocytes, 1,800,000 per cubic millimetre; leucocytes 17,000 per cubic millimetre; colour index, 0·69. The leucocytosis was associated with a fluctuating temperature varying about two degrees Fahrenheit *per diem*. The blood pressure was 108 millimetres systolic and 50 millimetres diastolic. Blood urea was 43 milligrammes *per centum*. No organisms were grown on incubation of the blood. During the patient's stay in hospital he developed œdema of the right leg and phlebitis followed by thrombosis of the basilic vein of his left arm. Dr. Maxwell said that the precise nature of the hepatomegaly had not been determined.

DR. J. NIHILL regarded a liver abscess as the probable cause of the patient's symptoms, but it was pointed out that no definite evidence had been obtained to confirm or disprove this diagnosis.

DR. M. D. SILBERBERG suggested that the fæces might contain an ætiological factor, and this investigation is now proceeding.

Jaundice.

The third patient, a male, aged sixty-seven years, illustrated a condition of transient jaundice, which had developed three days before admission to hospital and had increased in intensity for four days and then slowly subsided during the course of a fortnight. Prior to development of icterus the patient complained for ten days of slight pain in the right hypochondrium and also of pain in the region of the umbilicus. He was constipated and vomited on several occasions about two hours after taking food. Tenderness was present in the right hypochondrium. A fractional test meal showed absence of free hydrochloric acid and no pepsin present, a condition of *achylia gastrica*. A barium meal did not demonstrate any organic lesion in the gastro-intestinal tract. Cholecystography did not reveal any gall bladder shadow. In view of these findings and the transient character of the jaundice the condition was regarded as probably due to cholecystitis associated with cholelithiasis. Dr. Maxwell said that the patient refused operation and was being treated medically by dilute hydrochloric acid given with each meal, pepsin given with each meal, large doses of hexamine and magnesium sulphate given in concentrated solution in the early morning while the patient was fasting.

(To be continued.)

Correspondence.

HOSPITAL ABUSE.

SIR: The system suggested by Dr. Ken S. Smith (THE MEDICAL JOURNAL OF AUSTRALIA, July 18, 1931), that only those patients presenting a note from a practitioner should be attended to in public hospitals has many disadvantages.

1. The number of patients is so great that it would be an intolerable burden on practitioners to be asked to investigate the financial position of applicants in order to sign an admission form.
2. At the present time patients frequently present notes from practitioners recommending hospital treatment, and on inquiry by the investigating clerk it is found that they can afford private fees.
3. The practitioner may think he knows the financial position of the patient, but be unaware of a considerable banking account. The investigating officer at the hospital can take a sworn statement. Recently in Melbourne a patient was fined for making a false declaration.

Yours, etc.,
"VIDIO."

July 24, 1931.

THE COMMONWEALTH NATIONAL LIBRARY.

SIR: As perhaps you have heard, this library has received from Dr. J. H. L. Cumpston, Commonwealth Director-General of Health, his very complete and valuable collection of Australian medical works, and I feel sure that you will agree that Australia is greatly indebted to him for having presented this collection to our Commonwealth National Library.

The obligation, however, is now upon this library to see that the collection is adequately maintained and continued.

Under the Commonwealth *Copyright Act* of 1912, publishers of all books printed in Australia are required to supply copies to this library. Unfortunately, not all the publishers and printers seem to be aware of the law in this regard, and situated as this library is at Canberra, it is very hard indeed for me to keep in touch with all the Australian books issued, especially those of a medical and technical character, and so secure that copies are supplied to the library.

There is also the question of books and pamphlets privately printed, where the author is technically the publisher, and the securing of copies of these is very difficult.

I should be deeply grateful if you and the readers of your journal would keep in mind the library's requirements, and assist either by advising me of the publication of medical items which they think would not normally come under my notice, or by forwarding items for which they are themselves responsible.

Yours, etc.,
KENNETH BINNS,
Librarian.

Commonwealth National Library,
Canberra, F.C.T.,
August 8, 1931.

THE CEREBRO-SPINAL FLUID.

SIR: In connexion with the removal of cerebro-spinal fluid and the introduction of anæsthetics and of serums into the spinal theca arises the question as to how much cerebro-spinal fluid is present, more particularly the quantity below the level of the fourth ventricle.

I was not able to find the amount in text books, and apparently it is not a well known quantity, for estimates were given ranging from ten cubic centimetres to one hundred cubic centimetres.

In order to determine the answer I performed the following experiment in conjunction with Dr. H. J. Gray and Dr. Bradshaw.

A brain was removed at the level of the *foramen magnum*. A lumbar puncture needle was inserted at the level of lumbar 3-4. The body was upended and no more cerebro-spinal fluid dripped out. The body was then placed with the head at a higher level than the feet. A coloured solution (copper sulphate) was injected through the needle into the theca. The experiment was performed twice.

In the first the cadaver was five feet seven and a half inches and weighed approximately fourteen stone. It was found that 116 cubic centimetres of fluid were required before the blue solution appeared at the level of the *foramen magnum*.

The second one was a thin man, five feet six inches. The amount on this occasion was 106 cubic centimetres.

These amounts were greater than I expected, and perhaps the method was open to fallacy. They could readily be checked in the schools where there is more material.

I would be pleased to know the accepted correct amount.

Yours, etc.,
B. C. COHEN,
Honorary Pathologist and Assistant Physician, Perth Hospital.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A MEETING of the Senate of the University of Sydney was held on August 10, 1931.

Permission was granted for the holding of examinations during the August vacation for the Diploma in Tropical Hygiene and for Part I of the Diploma in Public Health.

The resignation of Dr. B. T. Mayes as Walter and Eliza Hall Medical Research Fellow was received and accepted.

The following appointment was approved: Dr. Elinor S. Hunt as Honorary Cancer Research Worker in the Bio-Physical Laboratory.

ROYAL COLLEGE OF SURGEONS OF ENGLAND.

AT the recent primary examination for the diploma of Fellow of the Royal College of Surgeons of England, held

in Melbourne, there were twenty candidates, of whom ten passed.

The successful candidates were: Bert Wilfred Buttsworth, M.B., B.S., Melbourne; Murray Alexander Falconer, University of Otago, New Zealand; Edward Woodall Gault, M.D., B.S., Melbourne; John Isaac Haywood, University of Melbourne; Reginald Angel Money, M.B., Ch.M., Sydney; Francis Patrick Morgan, M.B., B.S., Melbourne; Douglas Gordon Radcliffe, M.B., Ch.M., Sydney; Rutherford Kaye Scott, M.D., B.S., Melbourne; John Burstall Turner, M.D., B.S., Melbourne; Roy Douglas Wright, M.B., B.S., Melbourne.

Obituary.

MARTIN JOSEPH RYAN.

WE regret to announce the death of Dr. Martin Joseph Ryan, which occurred at Moonee Ponds, Victoria, on August 15, 1931.

HENRY EDWARD BROWN.

WE regret to announce the death of Dr. Henry Edward Brown, which occurred at Rockhampton, Queensland, on August 15, 1931.

Corrigendum.

IN the report of the meeting of the New South Wales Branch of the British Medical Association held at the Royal Prince Alfred Hospital on May 28, 1931, an account was given of a patient shown by Dr. R. K. Lee Brown. It should have been made clear that the operation of uretero-intestinal implantation described was based on experimental work carried out in the Department of Urology by Dr. P. N. Walker-Taylor.

Diary for the Month.

SEPT. 1.—New South Wales Branch, B.M.A.: Organization and Science Committee.
SEPT. 2.—Victorian Branch, B.M.A.: Branch.
SEPT. 3.—South Australian Branch, B.M.A.: Council.
SEPT. 4.—Queensland Branch, B.M.A.: Branch.
SEPT. 8.—New South Wales Branch, B.M.A.: Ethics Committee.
SEPT. 10.—New South Wales Branch, B.M.A.: Clinical Meeting.
SEPT. 15.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
SEPT. 22.—New South Wales Branch, B.M.A.: Medical Politics Committee.

Medical Appointments.

Dr. P. Tillett (B.M.A.) has been appointed Honorary Radiologist at the Coast Hospital, New South Wales, for a period of two years.

* * *

Dr. K. Voss (B.M.A.) has been appointed Assistant Honorary Radiologist at the Coast Hospital, New South Wales, for a period of two years.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xvi.

CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Male Junior Resident Medical Officers.
LEWISHAM HOSPITAL, SYDNEY, NEW SOUTH WALES: Senior Physician.
ROYAL AIR FORCE, MEDICAL BRANCH: First Commissions.
ROYAL NORTH SHORE HOSPITAL OF SYDNEY, NEW SOUTH WALES: Senior Resident Medical Officers (3), Junior Resident Medical Officers (5).

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company, Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members desiring to accept appointment in ANY COUNTRY HOSPITAL, are advised to submit a copy of their agreement to the Council before signing, in their own interests. Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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